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UTCS ComputerNews

FEATURING U OF T HIGH PERFORMANCE COMPUTING

HPC

Vector Supercomputing

Massively Parallel Supercomputing

Clusters of Workstations

Scientific Visualization

Also Inside:

Voice Mail Update

OS/2 2.0

SPSS for OS/2 & SPSS/PC+

Graphics Programs for UNIX Systems Running X-windows

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Thanks to Elizabeth Rayson for her assistance in editing this issue.

This newsletter was entirely produced on a Macintosh using PageMaker and other related Macintosh software.

Facing the Reality of Budget Cuts

In response to the budget cuts entailed by the low provincial government transfer payments to the University, Dr. C. David Sadleir, the vice-president of computing and communications, has been consulting with all UTCC staff on the changes to be made in the portfolio. Dr. Sadleir first met with all staff during March in a series of five sessions at which he presented details about the budget reality.

As a follow-up to these meetings, Dr. Sadleir invited staff to submit recommendations about how the portfolio could make cuts while preserving its strategic direction and improving its focus and quality of service. Six task groups were also struck with representatives from all levels within the portfolio to the extent practical. Each group was asked to identify options available in the topic area assigned.

The response from the staff has been substantial; as well as formal reports from the six task groups, several individual submissions have been provided for the vice-president's consideration. Dr. Sadleir is now reviewing the recommendations, and will use them to help him decide how to proceed.

The consultative process has of necessity diverted UTCC staff from their normal working duties, and the changes ahead will inevitably be disruptive in the short term. We thank you for your forbearance as we confront the difficult challenges we are facing.

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Advising and Consulting

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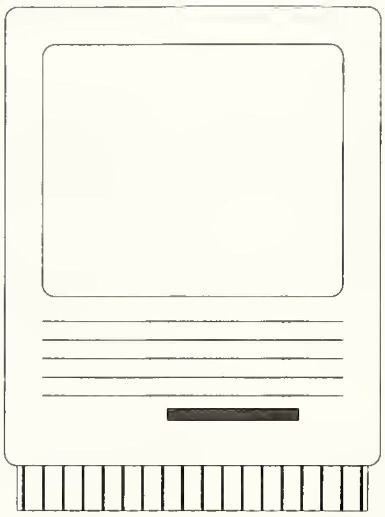
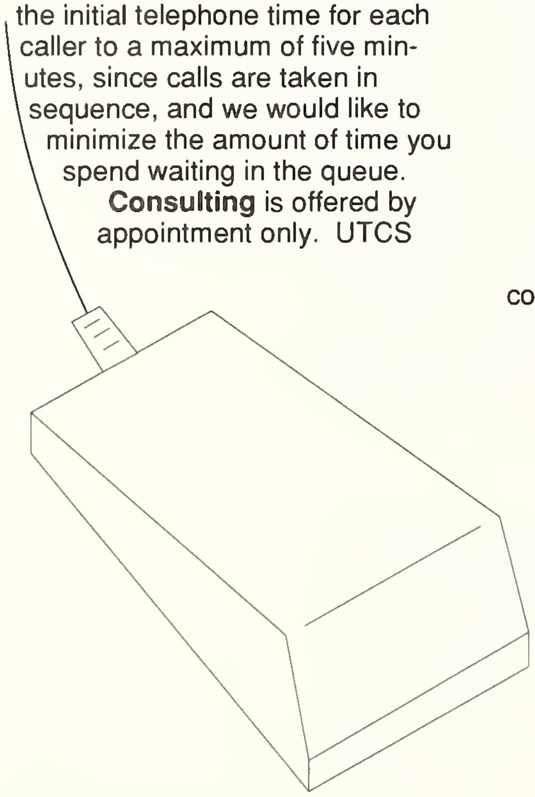
The UTCS Advising and Consulting group is available to University faculty, staff, and graduate students. We offer two levels of support: phone-in advising and consultations by appointment.

Phone-in advising is available from 978-HELP (4357) Monday through Friday between noon and 6:00 p.m. The HELP line is answered by student advisors trained by UTCS to deal with queries about the products we support. At the minimum, these advisors are expected to handle queries on any of the product features covered in UTCS' introductory short courses. The aim of Phone-in Advising is to answer quick questions immediately, offer a call back or an appointment for more difficult questions, or, if appropriate, redirect your call to another UTCS group. It is important for us to limit the initial telephone time for each caller to a maximum of five minutes, since calls are taken in sequence, and we would like to minimize the amount of time you spend waiting in the queue.

Consulting is offered by appointment only. UTCS consultants are full-time staff members with experience in all of the products we support. In addition to a general knowledge of our range of products, each of the four consultants specializes in at least one of four areas of application software: word processing, databases, spreadsheets, and statistical packages. Appointments are limited to a maximum of one hour and are available on a first come, first served basis as time allows. We will do our best to help you in a reasonable time, using all the resources available to us within UTCS and from vendor technical support.



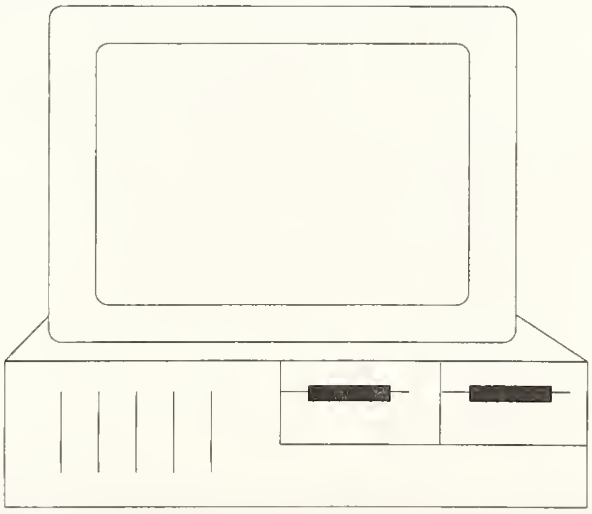


What Exactly Do We Support?

Below is a list of products supported by Advising and Consulting.

IBM Platform	**Macintosh Platform**
DOS	System & Finder
WordPerfect	Microsoft Word
dBASE IV	FoxBASE
Lotus 1-2-3	Microsoft Excel
ProComm	MacKermit
	QuickMail

Use of SAS , SPSSx, and SYSTAT is supported primarily by the statistics consultant; other consultants may have some knowledge of SAS.



News About Voice Mail

Debbie Stewart
Voice Communications

Since University of Toronto Voice Communications (UTVC) started writing for *ComputerNews* in the summer of 1990, we have often wondered if anyone read our articles. Few queries have resulted from our submissions.

We are no longer wondering! Some people are paying attention! We received many calls as a result of our article in the May/June issue. The calls came because of the announcement of the change in the voice mailbox numbers from four digits to five digits. Unfortunately, the change did not occur as scheduled. By the time this issue reaches you, we hope the changes will be behind us once and for all.

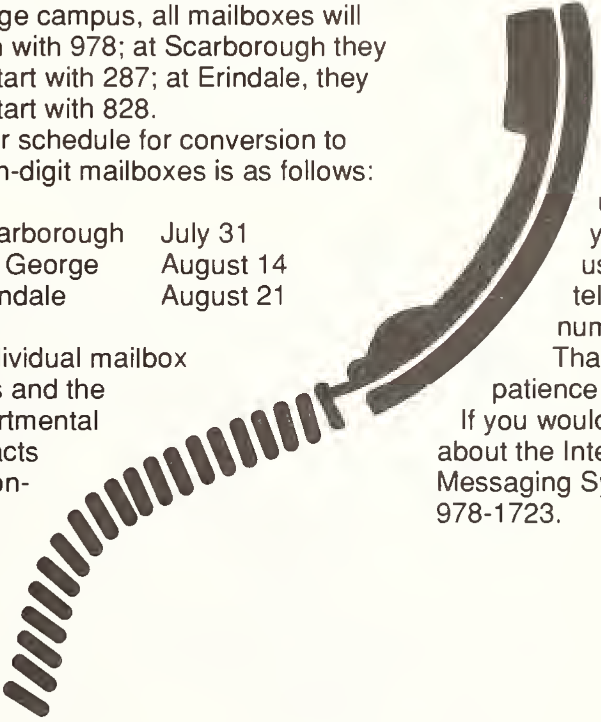
For those of you who have not kept up with this saga, a new release of software that allows us to network our three systems was installed on our Octel systems. To accommodate the networking, it is necessary to make all our voice mailbox numbers unique. We were instructed to change our mailbox numbers by adding a unique fifth digit to the beginning of each mailbox on each system. All went well with the conversion at Erindale. It was in the eleventh hour, before the change was to be done at Scarborough, that we were advised it would not work.

It was back to the drawing board. We have now determined that all mailbox numbers must be seven digits (your full telephone number) to accommodate our future plans to network our systems. On the St. George campus, all mailboxes will begin with 978; at Scarborough they will start with 287; at Erindale, they will start with 828.

Our schedule for conversion to seven-digit mailboxes is as follows:

Scarborough	July 31
St. George	August 14
Erindale	August 21

Individual mailbox users and the departmental contacts responsible for voice mail bulletin boards have been advised by memo of their new mailbox numbers.



This change in mailbox numbers affects all voice mail users. When you retrieve your voice mail messages from a telephone other than your own, you will have to key in your seven-digit telephone/mailbox number rather than your four-digit extension number. When you send voice mail messages to other voice mail users, you will have to remember to use their seven-digit telephone/mailbox number instead of their four-digit extension. Also, you will have to update any "group lists" you may have created to use the seven-digit telephone/mailbox number.

Thanks again for your patience with our growing pains.

If you would like more information about the Integrated Voice Messaging System (IVMS), call us at 978-1723.

OS/2 2.0

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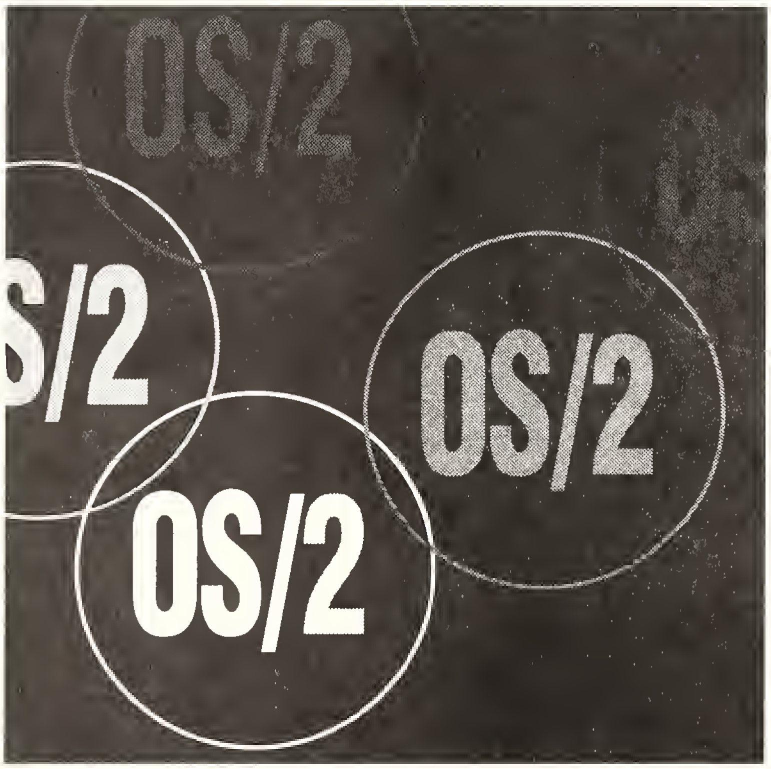
OS/2 has been with us for a while, but version 2.0, released in the spring of 1992, really is a whole new operating environment. OS/2 is a graphical user environment. You use a pointing device such as a mouse to select, move, copy, and in general manipulate objects such as data files, documents, and so on. While older versions of OS/2 could run OS/2 and DOS programs, version 2.0 also allows you to run Microsoft Windows programs.

The OS/2 2.0 screen display is completely graphical. Text on the screen looks as close as it possibly can to the printed output. OS/2 uses scalable outline font technology to provide accurate screen display and high-quality printed output from Windows and OS/2 applications.

Who should use OS/2 2.0? A user who does only word processing on his or her PC is not going to benefit from having OS/2 as the operating environment. On the other hand, someone who needs to run multiple DOS, Windows, or OS/2 programs at the same time would probably be more productive in an OS/2 environment. If you needed connectivity to a mainframe or access to network database servers, you could probably benefit from using OS/2 2.0 Extended Services.

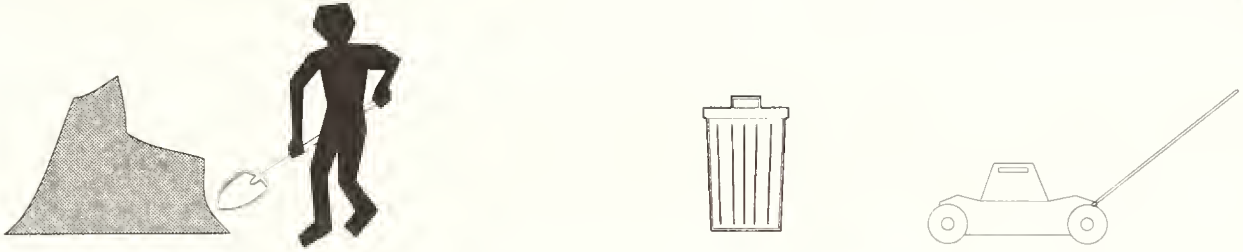


Machine Requirements

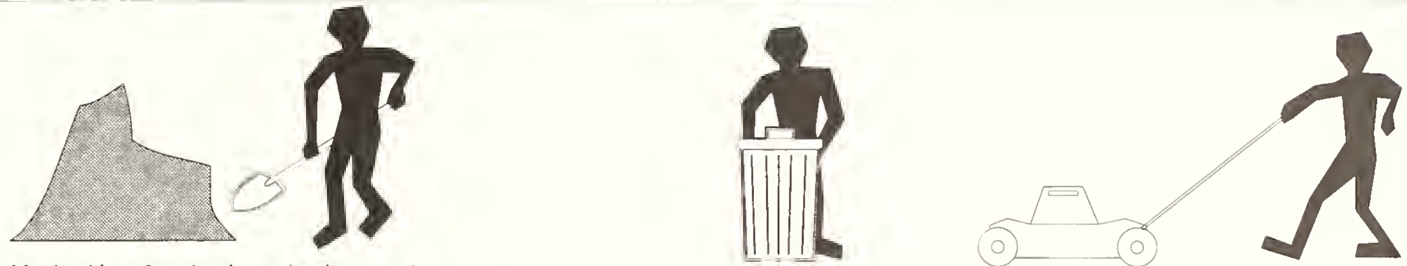
One of the first questions asked about OS/2 is how powerful a machine is required to run it. While there is no simple answer to this question, it is easy to say that OS/2 2.0 requires either an 80386SX, 80386, 80486SX, or 80486 central processing unit (CPU). OS/2 2.0 will run on both IBM computers as well as "clone" or compatible computers. You do not have to have a "true blue IBM machine" to use OS/2 2.0. XT- and AT-type computers will *not* run OS/2 2.0. You need between 15 and 30 megabytes (MB) of free hard disk space to install OS/2 2.0, and you need a bare minimum of 4MB of random access memory (RAM). My experience suggests that a 33 megahertz 80386 based computer with a 100MB hard drive and 8MB of RAM would provide reasonable performance running OS/2 2.0. Naturally, depending on the number and the types of applications you plan on using, you may need more RAM, more hard disk space, or a faster CPU.

Installation

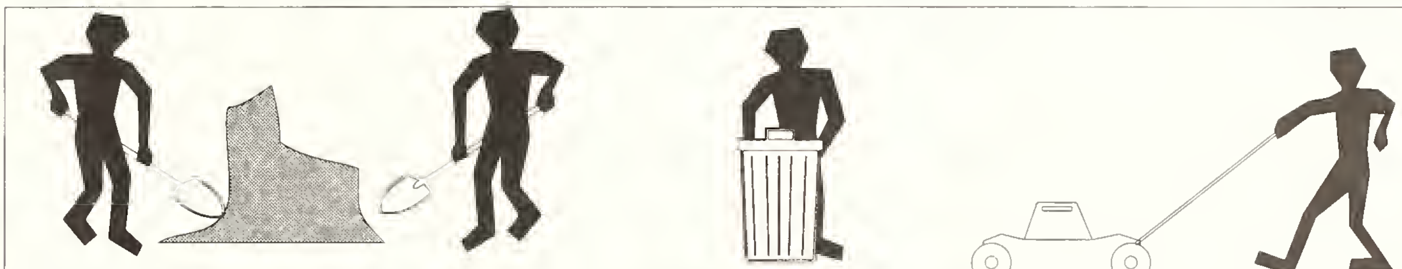
OS/2 installation is an automated process. The installation program automatically determines your machine configuration and loads the appropriate software drivers for your particular hardware configuration. Certain portions of OS/2 2.0 are optional. The installation process allows you to select which parts to install, and allows you to save disk space by not installing parts that you might never need. The time required can be as short as 45 minutes for a simple installation. If you choose to reformat and/or repartition your hard drive, the process can take considerably longer. While a two-hour installation may seem very long, it is comparable to a first-time installation of DOS and Windows combined with reformatting and partitioning your hard drive. You do not necessarily have to format your hard drive, but if you choose to format, you can select whether you want to use a File Allocation Table (FAT) file system like DOS uses, or a High Performance File System (HPFS) which will give you better performance when running OS/2. You may choose to install OS/2 alone, or you may configure your machine so that you can choose



Single-tasking: 3 tasks done sequentially.



Multitasking: 3 tasks done simultaneously.



Multitasking: 3 tasks done simultaneously.
Multi-threading: 1 of the tasks handled by two "threads".

between normal DOS or OS/2 at startup.

Documentation

The manuals provided with OS/2 are very small. They give basic information regarding installation of OS/2, and also cover fundamentals such as how to use a mouse. Full documentation is provided in the form of online reference information that is installed with OS/2. This online documentation can be searched, browsed, and printed easily once OS/2 is up and running.

Highlights of OS/2 2.0

OS/2 is a multitasking operating system. You can have two programs running at the same time. For example, you can format a floppy diskette, work in your word processor, or perform a hard disk backup to tape or floppies all while using your spreadsheet program. Multiple DOS programs, even those not specifically designed for OS/2, can be run at the same time.

OS/2 is also multithreading. This means that an OS/2 program that has been written to take advantage of this multithreading capability can do two things at once. For example, in some programs written specifically for OS/2, you can work on one document while you reformat another document at the same time.

DOS programs running under OS/2 can be configured to run as full-screen applications, using the entire screen for a particular program, or they can be run in smaller windows. Each DOS program running under OS/2 can have a custom configuration including CONFIG.SYS entries specific to each DOS program, the version of DOS that the program is running under, and many other parameters pertaining to memory management, keystrokes, interrupt handling, and so on.

OS/2 2.0 is available on 3.5-inch and 5.25-inch floppy diskettes. It can be ordered as a DOS upgrade, a Windows upgrade, or as a non-upgrade package. The DOS upgrade package will check the first time it is installed to see that there is a version of DOS on the disk where OS/2 is being installed. OS/2 2.0 has been priced aggressively to compete with DOS and Windows. Upgrades from DOS or Windows are available (at time of writing) for well under CDN$100.

All in all, IBM has done an excellent job of providing a good, stable platform for running DOS, Windows, and OS/2 programs from a single, integrated graphical user environment.

MacKermit 0.99(94)

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Kermit is the name for a popular computer protocol by which data is transferred from one computer to another. Developed at Columbia University, it is widely distributed, well documented, and used across many computing platforms.

UTCS distributes and supports a program called MacKermit, a communications package that runs on Macintosh computers. MacKermit integrates the Macintosh user interface's ease of use with Kermit's file transfer protocol. The latest version distributed and supported by UTCS is 0.99(94), a pre-release to the anticipated MacKermit version 1.0. Many significant modifications have been made since pre-release version 0.98(62) (see *ComputerNews,* May/June 1991). MacKermit now supports C-Kermit5a file transfer protocol modules. This enables MacKermit to incorporate all the latest protocol features found in C-Kermit, including sliding windows and character set translations. You will notice that many menus have been redesigned, although the menu design of version 0.99(94) is still undergoing changes.

Multiple Screen Windows

One significant change that was made to MacKermit 0.99(94) is the addition of multiple screen windows. Now you can utilize multiple windows for terminal emulation, command processing, text editing, and server responses. You can access windows easily with the Window menu by selecting any MacKermit window explicitly. Cutting and pasting material between windows is easy now; double-click to select a word or triple-click to select a line. Also, you can copy material to other applications. Pasting into the terminal windows sends text to the remote computer. Window sizing is done using the size box. Scrollback is possible with most windows. Font selection is available in the terminal window. The terminal session can also be logged directly into a file.

The Command Window

The Command window runs the C-Kermit command parser, just like that of Kermit on the UNIX or VMS platform, and similar to MS-DOS Kermit. This feature is handy because it gives you access to features that are not in the mouse/menu interface, most importantly the DIAL command and the limited script programming language. The C-Kermit command parser allows the same script programs to be used by C-Kermit on UNIX, VMS, the Amiga, OS/2, and so on, and by MS-DOS Kermit. You can use text command files as MacKermit startup files (similar to initialization files for MS-DOS Kermit or C-Kermit). Files can be referred to by their full path names in the SEND command, for example “send diskname:foldername:filename”, or by relative pathnames, for example “send ::foldername:filename”.

File Transfer

File transfer has been made more efficient via sliding window packet protocol and longer packets. In the command window, file transfer character set translation is available through the SET FILE CHARACTER SET, SET TRANSFER CHARACTER SET, and SET LANGUAGE commands. Locking shift packet protocol for the efficient transfer of 8-bit data over 7-bit communication channels, and dynamic packet size adjustment to adapt to communication line quality, also enhance the ease of file transfer within MacKermit. New to MacKermit is a file transfer thermometer which indicates the elapsed time during file transfer.

Obtaining MacKermit

To obtain a copy of MacKermit 0.99(94), bring a 3.5-inch floppy diskette to the Advising Desk (located at 4 Bancroft Avenue, Room 201) between 12:00 noon and 6:00 p.m., Monday through Friday. You will receive a copy of the program, a document outlining the keyboard mappings, and three keyboard definition settings.

Summary of New Features in MacKermit 0.99(94)

- Multiple screen windows
- Window sizing
- Kermit command parser (as on UNIX or VMS, similar to MS-DOS Kermit)
- Scrollback in most windows
- More efficient file transfer
- Transfer character set translation
- Transfer of 8-bit data over 7-bit communication channels
- Dynamic packet size adjustment
- Transfer thermometer

What is UTHPC?

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University of Toronto High Performance Computing

University of Toronto High Performance Computing (UTHPC) is a new group within the portfolio of David Sadleir, vice-president (computing and communications). UTHPC's mandate is to support the University community in all areas of high performance computing, including distributed computing using workstation clusters and massively parallel processing (MPP), as well as traditional vector supercomputing. In this article we discuss the group's history and goals and describe its present projects.

UTHPC was formed in the wake of the closure of the Ontario Centre for Large Scale Computation (OCLSC). The organization was staffed with the OCLSC employees who remained following the shutdown of the Centre, thus preserving the experience they had gained in many aspects of high performance and distributed computing and scientific visualization techniques. This expertise is a human resource which would be much harder to replace than the computer hardware itself.

Strategies

One of UTHPC's main strategies is to create an environment in which the University is "logically indifferent" to the ultimate location of any provincial or national high performance computing facility which might be established in the future. UTHPC should provide expertise in the use of such a facility and a logical gateway to it, including full pre- and post-processing capabilities.

It is also intended that broader areas of research be addressed. Researchers in many fields other than those in the physical sciences and engineering, which traditionally have used supercomputers, can benefit from high performance computing technology. Teaching can also benefit from the application of this technology.

Finally, many campus groups are involved in some related aspects of this activity, such as UTCS, IMS, the Media Centre, the Dynamic Graphics Project (DGP) group, and various research consortia. The opportunity for synergy exists in the sharing of equipment and expertise among the several groups. This should be identified and exploited where possible.

The current goals of the newly created UTHPC are to:

- provide transitional support for University of Toronto researchers who require access to a vector supercomputer for their research;
- gain experience and expertise in parallel computing;
- experiment with distributed processing over networks;
- enhance our visualization capability.

We will consider each of these items in more detail.

Vector Supercomputing

There is a class of problems in science which can be dealt with effectively only by the use of very high performance computers. It is important that University of Toronto researchers with computationally intensive problems in a broad range of engineering and scientific disciplines have access to such computers in order to remain at the forefront of their research. Typical groups which rely heavily on these methods include Astronomy, Atmospheric Physics, Aerospace, Civil Engineering, Metallurgy, Chemistry, Computer Science, Mechanical Engineering, and others. In addition, the OCLSC experience demonstrated that there is a demand from industry and government for access to high performance computing.

Currently, the highest performance computers are represented by vector supercomputers, a mature and well understood technology. To provide temporary support for researchers who were left without access to a high performance computational engine due to the closure of the OCLSC, the University purchased a limited amount of computing resources from the Pittsburgh Supercomputer Center (PSC). Former OCLSC users have been offered an opportunity to use the Pittsburgh Supercomputer Center in order to finish their existing projects. These users will be able to utilize the PSC CRAY Y-MP vector supercomputer.

Service provided by UTHPC includes assisting users to gain access to the remote site and its services, providing administrative support in setting up accounts and monitoring account usage, providing support in programming and algorithm development on the supercomputers, and producing local documentation and conducting seminars on these topics.

To date nine users have acquired PSC accounts. They also attended a seminar which focussed on the use of the PSC system and the differences between the PSC and the OCLSC. In addition, UTHPC produced a guide specifically designed for University of Toronto users of the PSC facility.

Massively Parallel Supercomputing

A relatively new technology is that of massively parallel processing (MPP). Though more difficult to use, MPP systems hold a great deal of promise and are expected to be a dominant force in supercomputing in the future.

One of UTHPC's primary goals is to provide a core of expertise to assist researchers and graduate students to learn how to apply high performance computing technology. This is especially important for MPP systems, which require much more support in the form of algorithm and program development and education. In this context the University's relationship with the PSC also provides an opportunity to experiment with parallel processing on the PSC Connection Machine 2 (CM-2), a massively parallel computer from Thinking Machines Corporation (TMC). Two of UTHPC's staff have received preliminary training on the CM-2. They are presently developing an introductory workshop, to be offered in mid-August, on programming the Connection Machine. In fact, this workshop is an introduction to an in-depth course that UTHPC is organizing in conjunction with PSC instructors to be given in early fall.

UTHPC is currently working with a user in the Department of Astronomy to convert a general N-body serial code written in C to C* (TMC's C with extensions to support parallel programming). This will be run on the PSC's CM-2 (as well as their CM-5 when it becomes available).

> *MPP systems hold a great deal of promise and are expected to be a dominant force in supercomputing in the future*

Clusters of Workstations

This refers to distributing an application across multiple workstations (or other computing elements) to achieve higher performance than could be achieved on a single workstation. It can be thought of as a virtual supercomputer spread across a network.

There are several reasons why this is an attractive proposition. Workstations are ubiquitous, rapidly increasing in power, and decreasing in price. With sufficiently powerful workstations, a cluster of substantial aggregate power can be assembled relatively inexpensively. Some departments at the University already have large numbers of workstations. There is also a perception that a great deal of computing capacity sits idle on peoples' desks in the form of unused workstations (i.e., at night or on weekends). Being able to harness these "spare cycles" in an organized fashion could leverage the existing investment in these machines and provide essentially free high performance computing. In addition, one of the main appeals is the ability to be able to do parallel computing without having to purchase a parallel computer.

The key to making this approach work is the underlying software that allows the program developer to divide applications into components that can be executed in parallel on discrete machines. It is the responsibility of this software to provide inter-processor communication and to coordinate processor activities. Of the available systems, UTHPC has decided to focus on Network Linda and PVM (Parallel Virtual Machine). Both systems are well supported and well on their way to becoming standards in the field. They provide somewhat different approaches to parallel programming.

PVM is a programming environment for the development and execution of large concurrent or parallel applications that consist of many interacting, but relatively independent, components. PVM support software executes on a variety of machine types connected across multiple heterogeneous networks, and presents a unified, general, and powerful computational environment for concurrent applications. PVM is fully supported by Oak Ridge National Laboratory (Oak Ridge, Tennessee) from whom it is available at no cost. PVM supports both the FORTRAN and C programming languages by means of easy-to-use library routines.

Network Linda is a network implementation of the Linda parallel programming language developed by David Gelernter at Yale University. Conceptually, parallelism in Linda is based on a logically global memory called tuple space. Linda is implemented by adding six new programming operations to standard programming languages. Use of these new operations permits the user to create and coordinate parallel processes. Currently it supports only the C programming language, although a FORTRAN version is expected in the third quarter of 1992. Network Linda is available commercially from Scientific Computing Associates.

UTHPC is interested in working with researchers to help develop distributed processing applications (see WANTED: Distributed Computing Applications). At present, UTHPC is cooperating with the Canadian Institute for Theoretical Astrophysics (CITA) to distribute one of their applications across a cluster of Sun and IRIS workstations. The application is sufficiently coarse grained that it can be broken into components that can execute semi-independently on the workstations. We believe it will make a good test case for a distributed application. Initially the strategy is to distribute the application using both Network Linda and PVM (independently), thereby gaining familiarity with both systems. UTHPC plans to make the experience gained by using these systems available to the University community.

WANTED: Distributed Computing Applications

University of Toronto High Performance Computing (UTHPC) has been working with some software packages that attempt to distribute the work required to solve a computationally intensive problem among a network of workstations. We have found that for some problems, it is possible to obtain much better performance than that which could be obtained from a single workstation. In certain cases, the use of a large cluster of workstations can be expected to result in better performance and/or cost-performance than could be achieved using vector or MPP supercomputers.

Two of the packages UTHPC has been investigating, PVM (Parallel Virtual Machine) and Network Linda, are described in the accompanying article. UTHPC is presently running both of these software systems on our local area network, and would like to invite interested University of Toronto researchers to investigate the use of these products as tools in the solution of their computationally-intensive problems.

For more information please contact Allen Forsyth of UTHPC at 978-6601.

Scientific Visualization

An increasingly important part of research computing is visualization. In broad terms this refers to converting data into images to ensure the integrity of the analysis, to provoke insights into the science, and to communicate those insights to others.

At the high end, scientific visualization is a necessary component of supercomputing. Usually the results of computational science experiments are expressed as three-dimensional (3D) images or animations. For example chemists might visualize molecular interactions, aerospace engineers might visualize air flow over an aircraft wing, and mechanical engineers might visualize stress distribution in a structure. Visualization also encompasses more prosaic tasks such as the generation of two-dimensional (2D) charts and graphs or line plots, whether for individual use, display at conferences, or publication.

The two basic components of visualization are production of images from data and transfer of the images to some display medium, usually paper, film, or videotape. There are currently several groups at the University engaged in these activities.

UTHPC still owns and operates the OCLSC scientific visualization facility to supply high-end visualization services to researchers. Staff are available to assist researchers with image generation using visualization software and custom programming. UTHPC also provides standard software packages and libraries that users may use on their own in generating line plots. UTHPC's primary visualization engine is a Silicon Graphics IRIS workstation.

UTHPC's major goals in this area are to widen the capabilities of the facility, extend its services to the University research community, and establish liaisons with appropriate groups to leverage the investment in existing hardware and software.

Even among different scientific disciplines there are certain common image generation tasks, such as 3D rendering of solids, display of scalar and vector fields, iso-surface extraction, and so forth. An effort is underway at UTHPC to identify emerging standards in image representation and software for these tasks, and to make these available to users so that they may do their visualization without relying on UTHPC staff for custom programming.

UTHPC also provides facilities for transferring images to film and animations to videotape, and for videotape editing. Similar capabilities are available elsewhere on campus, such as the Dynamic Graphics Project at the Computer Systems Research Institute (CSRI). The feasibility of establishing a physical link between DGP and UTHPC is being investigated, as is the feasibility of sharing human resources, for instance giving graduate students in CSRI the opportunity to work on real visualization projects.

Summary

UTHPC will continue to support University of Toronto researchers engaged in all forms of high performance computing, whether it be vector, massively parallel, or distributed. Our phone number is 978-8255 and we invite enquiries.

Report on the International Conference on Computing and Learning:

ICCAL '92

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The fourth International Conference on Computing and Learning (ICCAL) was held from June 17 through June 20, 1992, at Acadia University, Wolfville, Nova Scotia. The conference was designed to be a "forum for the exchange of ideas and presentation of developments in the theory and practice of computer uses in education", with a focus on post-secondary education.

Multimedia

There were two broad themes to the conference: artificial intelligence in education, and multimedia in education. I will focus first on multimedia, since it has received a lot of attention in the last couple of years. The idea behind multimedia is to use the computer to deliver educational works that combine multiple media—video, still images, sound, animations, and text. Multimedia often gets called "hypermedia", which is multimedia information organized in a nonlinear, "hyper" fashion. Media as different as sound and text have to be organized in a hypertextual fashion to a certain extent, since there is no way to combine such media in a linear fashion.

In one of the keynote addresses, Herman Maurer, from Graz University of Technology (Austria), gave a number of reasons why he felt hypermedia was important.

1. *It allows us to browse "associatively" through information, in a way that may be similar to our "thinking processes."*

This interesting claim has been made by a number of people about hypermedia, but it has not been supported by evidence. I wonder if: a) we really do think that way, and b) it is advantageous to access information that way, however we may think. After all, we don't build cars with legs just because that is how we walk; likewise, it might be best to build information systems that work with the way we think, not like the way we think. Nonetheless, it is a claim that should be investigated further.

2. *Hypermedia systems allow us to "rearrange and anotate (sic) information for later use", not just by the annotator, but by others.*

Ideally, one could access annotations by others when reading, to get a different perspective on the information. It would be a bit like reading book reviews in conjunction with the book itself. Or it might end up like reading a well-used library book, in which the scrawls of other readers overcome the original text. I suspect a personal annotation system would be useful, but the annotation of others without intelligent editing less so.

3. *"Many complex issues of modern society are not linear in nature, but consist of many mutually interwoven aspects" and such issues "can be described much better using a multi-dimensional web of chunks of information".*

I run hot and cold on claims like this. On the one hand, one can hardly dispute that many issues have many interwoven aspects. On the other hand, good writers seem able to do just that: weave different themes and aspects into a single linear fabric. A well-woven whole is worth more than an undigested grab bag of information.

From a different perspective, noncomputerized hypermedia systems already exist. A good library interrelates a number of works with navigation mechanisms (such as the card catalogue). A computer-mediated hypermedia system would be like a library at one's desk. References in books could trigger the appropriate works, without having to retrieve the reference manually. I believe this is Maurer's vision of a shared, network-accessible hypermedia environment. While I can imagine how useful this would be for the researcher, I wonder if it will make life easier for the learner. If anything, it would make the process of learning more complex. Learners would have to know how to navigate a complex network environment before being able to get at specific information relevant to any given course. Anyone who has explored the services available on the INTERNET has experienced how complex such an environment can be. I suspect that teachers using such an environment would have to create paths through the information, much like a reading list. Such a linear path might end up looking like linear text after all. My point is that such a super-hypermedia system, while of interest to the researcher, might simply add to what a student has to learn.

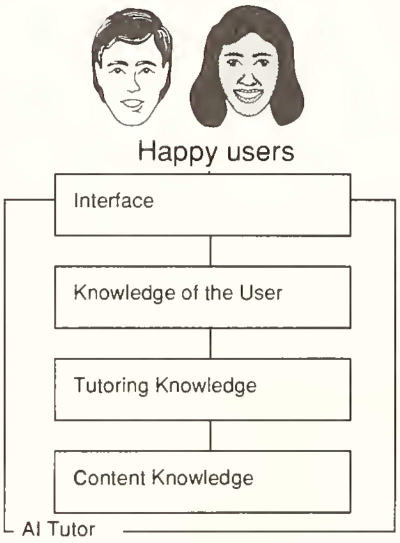
In addition to his discussion of multimedia, Maurer also raised an interesting point about communication. He argued that, with the mouth, we have a device that can produce information for the ear, but that we have no such device that matches the eye. He suggested that a visual prosthesis that would allow us to easily "talk" visually is necessary. He described something like an electric chalkboard that would magically appear above our heads, enabling us to illustrate what we are saying. This electronic chalkboard would be used in the way that chalkboards are used in the classroom. While I don't think the analogy holds (gestures correspond nicely), the point is still worth considering. With the miniaturization of computers, and the arrival of Personal Digital Assistants (Apple's name for hand-held, pen based systems), we could see systems designed to extend and complicate our everyday encounters. I can imagine feeling unable to communicate if I have left my Personal Digital Assistant at home; it would be like being caught without my appointment book. Such devices could bring multimedia into everyday conversation. I'll leave it to the semioticians to work out the implications of this technology.

Artificial Intelligence

There was a lot of talk and demonstration of educational systems that had "artificial intelligence" (AI). I should state at the outset that I have little experience in the area with which to judge the AI component of these systems.

Beverly Woolf from the University of Massachusetts both presented a keynote address, and gave a workshop on the subject. Unfortunately for those of us who paid for the workshop, the two events were essentially the same. I thus had the opportunity to hear her cover the same ground twice, which, given my inexperience, was probably helpful.

Woolf argued that AI tutorial systems are superior to traditional systems, if they are properly designed. One of the more convincing reasons she gave was that in an AI system, one can isolate the knowledge the system has about how to tutor from the knowledge it has of the subject matter. In a traditional system, the two are intertwined, so that to modify one, you have to rebuild both. An AI system should also be able to respond more imaginatively to students, adapting its model of the user during use. A traditional tutor is usually designed for a particular audience (for example, introductory Chinese students), and will not adapt to different users, let alone variations among the target audience.



One of the obvious problems with such an intelligent system is the time that it would take to build it. To this she had two answers. First, she argued that certain parts of such an AI system, being content independent, should be able to migrate from tutorial to tutorial. Tutoring knowledge, once programmed, should be reusable, thereby cutting down development time on the second tutorial. This led to her second claim that a large AI system should take no longer to program than a similar traditional system. Because the tutoring knowledge is transportable, with properly designed shells comparable to the traditional authoring systems like HyperCard, we should be able to build AI systems just as easily. With such a shell, and approved tutoring knowledge in place, a content expert would only have to put in the required target knowledge. The catch is that no such shells exist. To her credit, Woolf was frank about the absence of such shells. So, the rest of us will sit and wait for the realization of this promise–a promise that, I should add, may be well worth waiting for.

Anyone who would like to discuss these issues or find out more about the conference should contact me at 978-4548 or by electronic mail at *rockwell@gpu.utcs.utoronto.ca*.

Microcomputer Short Courses

Irene Rosiecki
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UTCS offers various noncredit microcomputer courses to faculty, staff, and graduate students of the University of Toronto. These courses cover a number of software programs available for the PC or the Macintosh. Whether you will be typing a thesis on a word processor, or working with spreadsheets, databases, or desktop publishing, we may be able to help you get started.

Our class sizes are small to allow for much individual attention. In most cases, continuing support is available upon completion of a course.

The following is a list of the microcomputer courses taught at UTCS:

- Introduction to dBASE IV
- Introduction to Disk Operating System (DOS)
- Electronic Mail Seminar
- Introduction to Microsoft Excel on the Macintosh
- Introduction to FoxBASE+/Mac 2.0
- HyperCard Seminar
- Introduction to Lotus 1-2-3
- Introduction to PageMaker
- ProComm Communications Seminar
- Introduction to SAS on the PC
- Intermediate SAS - Data Processing
- Intermediate SAS - Statistics
- SAS/Graph Seminar
- Introduction to Microsoft Word on the Macintosh
- Introduction to WordPerfect 5.1
- Advanced WordPerfect 5.1 Topics

To find out about course dates and registration procedures, or to book a place in any of these courses, please contact Irene Rosiecki at 978-4565. Courses are filled on a first-come, first-served basis. The more popular courses fill up quickly, but waiting lists are maintained in case of cancellations.

INTERNET NOTES

Network Reading List Available

Herb Kugel
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A very fine list of resources for network managers, developers, and in-depth users of the INTERNET is available on the INTERNET. The publication is called *NETWORK READING LIST: TCP/IP, UNIX, and Ethernet.*

This reference is well worth having. It is probably not for the novice user, although there is considerable information that could help him or her. It does offer a great deal of valuable bibliography for more experienced users. The *Network Reading List* was written by Charles Spurgeon, of the UTnet Network Information Center of the University of Texas at Austin. It exists in both "txt" (text) and "ps" (PostScript) format. I used File Transfer Protocol (FTP) to obtain my copies from the /pub/dduke directory from mailer.cc.fsu.edu, though I am sure it can be found elsewhere. The file names are net-read.ps and net-read.txt.

For more information, send electronic mail to *herb@vm.utcs.utoronto.ca* or *herb@gpu.utcs.utoronto.ca.*

File Transfer Protocol Under VM/CMS

Herb Kugel
herb@vm.utcs.utoronto.ca

Once again we have been asked about the File Transfer Protocol (FTP) under VM/CMS. Last month we discussed the BITFTP server; now we will illustrate the procedure using the VM TCP/IP package. The dialog is the same as what you would use on a UNIX-based system, but as the messages from the server are different, an example might be helpful.

In the following dialog, we determine whether the publication rfc1175, *A Bibliography of Internetworking Information*, is available from the Network Information Centre (the NIC) and then obtain it. We also replace any existing copy currently on our VM system. (Text that you are to type is preceded by a pointing hand ☛.)

```
Ready; T=0.01/0.01 21:14:43
                                      ☛ getme tcpip <RETURN>
Ready; T=0.36/0.45 21:14:52
                                      ☛ ftp nic.ddn.mil <RETURN>
VM TCP/IP FTP V2R1
Connecting to NIC.DDN.MIL 192.112.36.5, port 21
220-*****Welcome to the Network Information Center*****
    *****Login with username "anonymous" and password "guest"
    *****You may change directories to the following:
      ddn-news          - DDN Management Bulletins
      domain            - Root Domain Zone Files
      iesg              - IETF Steering Group
      ietf              - Internet Engineering Task Force
```

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```
      internet-drafts   - Internet Drafts
      netinfo           - NIC Information Files
      netprog           - Guest Software (ex. whois.c)
      protocols         - TCP-IP & OSI Documents
      rfc               - RFC Repository
      scc               - DDN Security Bulletins
      std               - Internet Protocol Standards
220 And more!
USER (identify yourself to the host):
                                        ☛ anonymous <RETURN>        (Log in as "anonymous")
>>>USER anonymous
331 Guest login ok, send "guest" as password.
Password:                               ☛ guest <RETURN>

>>>PASS ********
230 Guest login ok, access restrictions apply.
Command:
                                        ☛ cd rfc <RETURN>           (Change to the rfc directory)
>>>CWD rfc
250 CWD command successful.
Command:
                                        ☛ ls rfc1175.* <RETURN>                (Determine if the rfc
>>>PORT 128,100,100,2,58,144                                                  you want is available)
200 PORT command successful.
>>>NLST rfc1175.*
150 Opening ASCII mode data connection for file list.
rfc1175.txt                                                            (The system says it is present)
226 Transfer complete.
Command:
                                        ☛ get rfc1175.txt (replace <RETURN> (Get and replace a
>>>PORT 128,100,100,2,58,148                                              previous copy of the rfc)
200 PORT command successful.
>>>RETR rfc1175.txt
150 Opening ASCII mode data connection for rfc1175.txt (94417 bytes).
226 Transfer complete.
96829 bytes transferred. Transfer rate 11.16 Kbytes/sec.
Command:
                                        ☛ quit <RETURN>                      (And then quit)
>>>QUIT
221 Goodbye.
Ready; T=1.63/2.30 21:16:44
```

This should help VM/CMS users who would like to use the INTERNET FTP facility, but who are not currently interested in or do not have access to a UNIX hardware machine.

If you have any questions about this or any other matters relating to the INTERNET, please send electronic mail to *herb@vm.utcs.utoronto.ca* or *herb@gpu.utcs.utoronto.ca*.

Understanding Archie Through FTP

We will now illustrate how to obtain Archie documentation using the VM/CMS system. We will obtain the Archie article that is reprinted on page 19, as well as the Archie documentation. The latter could be helpful in understanding the process of using Archie to search for information about mythology, the example we use in "Using Archie to Find Information."

To obtain Archie documentation under VM follow the procedure below (text that you are to type is preceded by a pointing hand ☛).

```
                              ☛ getme tcpip <RETURN>            (Get the file transfer package)
Ready; T=0.37/0.47 13:02:18
                              ☛ ftp archie.mcgill.ca <RETURN>          (File transfer protocol
VM TCP/IP FTP V2R1                                                       to the archie machine)
Connecting to ARCHIE.MCGILL.CA 132.206.2.3, port 21
220 quiche.CS.McGill.CA FTP server (SunOS 4.1) ready.
USER (identify yourself to the host):
                              ☛ anonymous <RETURN>              (You log in as 'anonymous')
>>>USER anonymous
331 Guest login ok, send ident as password.
Password:                     ☛ herb@vm.utcs.utoronto.ca <RETURN>        (Send your logon id)

>>>PASS ********
230 Guest login ok, access restrictions apply.
Command:
                              ☛ cd archie/pub <RETURN>
>>>CWD archie/pub                                                  (Change directories)
250 CWD command successful.
Command:
                              ☛ ls <RETURN>                       (Find out what's there)
>>>PORT 128,100,100,2,157,16
200 PORT command successful.
>>>NLST
150 ASCII data connection for /bin/ls (128.100.100.2,40208) (0 bytes).
README
archie-iusage.data
archie-iusage.ps.Z
archie-present.ps.Z
archie-present.tex.tar.Z
archie-usenix92-paper.ps
archie-usenix92-paper.ps.Z
archie-usenix92-paper.txt
archie-usenix92-paper.txt.Z
archie.man.nroff
archie.man.nroff.Z
archie.man.roff
archie.man.txt
archie.man.txt.Z
giflist.Z
ls-format
old
prospero
```

```
usenix-archie-citation
usenix.paper.ps
usenix.paper.ps.Z
usenix.paper.txt
usenix.paper.txt.Z
whatis.archie
whatis.archie.Z
226 ASCII Transfer complete.
Command:
                              ☛ get whatis.archie <RETURN>                (Get whatis.archie)
>>>PORT 128,100,100,2,157,17
200 PORT command successful.
>>>RETR whatis.archie
150 ASCII data connection for whatis.archie (128.100.100.2,40209) (9385 bytes).
226 ASCII Transfer complete.
9631 bytes transferred. Transfer rate 5.23 Kbytes/sec.
Command:
                              ☛ get archie.man.txt archie.doc <RETURN>          (Get archie
>>>PORT 128,100,100,2,157,24                                                documentation)
200 PORT command successful.
>>>RETR archie.man.txt
150 ASCII data connection for archie.man.txt (128.100.100.2,40216) (28669 bytes)
.
226 ASCII Transfer complete.
29559 bytes transferred. Transfer rate 8.38 Kbytes/sec.
Command:
                              ☛ quit <RETURN>                                  (And leave)
>>>QUIT
221 Goodbye.
Ready; T=1.45/2.14 13:04:29
```

You should know that the naming conventions for VM files are far different from UNIX files. VM files are in the form of File Name File Type Filemode (FN FT FM), so the UNIX file named “whatis.archie” will become the VM file WHATIS ARCHIE A1. When a UNIX file has more than one dot in the filename, such as archie.man.txt, a local variable name (archie.doc, in this case) must be given to allow the file to come across to VM as ARCHIE DOC A1. This local variable must be assigned for any UNIX file of the form a.b.c (or greater).

Using Archie to Find Information

Now that we have looked at how to use Archie, let’s try to find some information about mythology (as an example). In all the previous examples in these columns, we have always shown the console log; that is, in VM we used the SPOOL CONSOLE command and in UNIX we used the SCRIPT command to obtain a record of what we did.

However, this approach will not work when we use Archie, or, in general, when we TELNET to other servers. In File Transfer Protocol (FTP), we are merely transferring information from a remote machine to our machine. In TELNET, we are involved in a dialog with a remote machine, and as the process is different, the spooling commands on the local machine are often inadequate for this situation.

However, there is a way around this. Please consider “our” side of a dialog which may be originated from either a VM or UNIX machine (text that you are to type is preceded by a pointing hand ☛).

```
☛ getme tcpip <RETURN>                      (VM/CMS users only)
☛ telnet archie.sura.net <RETURN>      (VM and UNIX users type)
```

After the Archie response, you would log in as "archie" (lower case only; no password required). Suppose you are interested in, say, mythology. You would issue the following commands to Archie:

```
archie>                     ☛ set search sub <RETURN>
archie>                     ☛ prog myth <RETURN>
```

Archie would then search its databases and a great deal of output would move across your screen rapidly, much more than you could or would want to copy. However, after Archie finishes its search you would issue the following commands to it:

```
archie>                     ☛ mail herb@vm.utcs.utoronto.ca <RETURN>       (Type your own
archie>                     ☛ bye <RETURN>                                 e-mail address!)
```

In the above, "set search sub" defines the conditions for this particular Archie search. A match is obtained when the sub (substring) is found in any file in the Archie databases. This search is case insensitive. The "mail" command then sends the output from the last command (in this case the "prog" command which initiated the search for the string "myth") to the electronic mail address you gave it, *"herb@vm.utcs.utoronto.ca"*.

Some of the received back output looks like this:

```
 Host iesd.auc.dk   (130.225.48.4)
Last updated 11:14  4 Jun 1992
    Location: /myth/old
       FILE      rw-rw-r—     293658  May 17  1990   myth-1.02a+.tar.Z
Host mc.lcs.mit.edu   (18.111.0.179)
Last updated 05:10  7 Jun 1992
    Location: /its/ai/jlv
       FILE      r—r—r—      12318  Sep 26  1990   myth.mss.Z
Host phloem.uoregon.edu   (128.223.32.35)
Last updated 05:03 11 Jun 1992
    Location: /pub/Sun4/lib/word-lists
       FILE      rwxr—r—      11583  Jul 12  1991   myths-legends
```

This information consists of the address of the "myth" information, a location in a directory, and the name of the file in the directory with the string "myth" in its name. There are various types of files in the list. We will discuss these file types in detail in an article next month, but for now let's concentrate on the simple file "myths-legends". To look at it we initiate the following dialog, which, by now, I hope is becoming familiar. It is the same sort of dialog that we used to obtain the Archie documentation, discussed previously in this article.

```
                                ☛ getme tcpip <RETURN>               (Get the tcpip package)
Ready; T=0.38/0.49 15:23:10
                                ☛ ftp phloem.uoregon.edu <RETURN>    (Access the remote server)
VM TCP/IP FTP V2R1
Connecting to PHLOEM.UOREGON.EDU 128.223.32.35, port 21
220 phloem FTP server (Version 6.15 Tue Feb 18 09:12:48 PST 1992) ready.
USER (identify yourself to the host):
                                ☛ anonymous <RETURN>                          (Normal login)
>>>USER anonymous
331 Guest login ok, send e-mail address as password.
Password:                       ☛ herb@vm.utcs.utoronto.ca <RETURN>   (Will not display on screen)
>>>PASS ********
230- 230-Welcome to the University of Oregon Network Services Archive.
230-
230-If have any unusual problems, please report them via e-mail to
```

```
230-nethelp@ns.uoregon.edu or via telephone at 503/346-4395.
230-
230-Local time is Fri Jun 26 12:24:28 1992
230-
230 Guest login ok, access restrictions apply.
Command:                          ☛ cd /pub/Sun4/lib/word-lists <RETURN>     (Change directories to
>>>CWD /pub/Sun4/lib/word-lists                                              the word-list directory)
250 CWD command successful.
Command:
                                  ☛ get myths-legends myths.legends <RETURN>        (See below!!!)
>>>PORT 128,100,100,2,235,134
200 PORT command successful.
>>>RETR myths-legends
150 Opening ASCII mode data connection for myths-legends (11583 bytes).
226 Transfer complete.
12946 bytes transferred. Transfer rate 2.27 Kbytes/sec.
Command:
                                  ☛ quit <RETURN>
>>>QUIT
221 Goodbye.
```

In the above, we used information in Archie to obtain the UNIX file “myths-legends”. Notice that we used the local file name myths.legends which was translated into MYTHS LEGENDS A1 under VM. Now, for those who may be curious, we show the beginning and end of the file we have obtained:

```
# Beasts and characters from mythology and legends
#
# Taken from AD&D games, Bulfinches Mythology, and
# “A Dictionary of Fabulous Beasts”, R. Barber & A. Riches, Walker & Co, NY
#
abaia
abath
achelous
achilles
achiyalabopa
      .
      .
      .
      .
zombie
zoroastrian
zruty
zu
zushta
```

We ran this search twice, once at 7:00 a.m. and then again at peak time, 3:00 p.m. The first search took three minutes of elapsed time; the second fifteen. Archie is very popular; you can save yourself time and expense by trying to run your searches during non-peak hours.

While Archie is a powerful system, it is not the only one used to obtain information about material on the INTERNET. Next month we will introduce the test “gopher” system on the VM/CMS system at the University of Toronto.

In the meantime, if you have any questions, send electronic mail to *herb@vm.utcs.utoronto.ca* or *herb@gpu.utcs.utoronto.ca*.

The INTERNET and Archie Revisted

Although we have discussed both the INTERNET and Archie in previous issues of *ComputerNews*, a new school year means new people are arriving who may not have heard of either. Briefly, the INTERNET is a network of networks through which users may obtain a great deal of information on a vast array of topics through a process called File Transfer Protocol (FTP). This, too, has been discussed before, but may be unfamiliar to some and may still cause problems for others. This process is explained in "File Transfer Protocol Under VM/CMS" and "Understanding Archie Through FTP."

Archie, for those unfamiliar with it, is a powerful tool that allows you to search for specific keywords on the INTERNET. Perhaps the best way to introduce both the INTERNET and Archie is through the information and documentation prepared by the Archie team. As Archie has proven so popular, I am quoting the article in full should specific users wish to get in touch with the Archie software team.

*****

"archie - An Electronic Directory Service for the Internet"

Peter Deutsch,
Alan Emtage,
Bill Heelan,
Computing Centre,
McGill University.
email: archie-group@archie.mcgill.ca

Introduction

Few other areas in the field of computer science hold out such promise for significant performance gains in the coming years as the field of computer networking.

While even a single computer allows the user to access and process information faster and more accurately than ever before, joining large numbers of such computers together with the communications tools needed for users to easily share information and resources promises the prospect of a true "electronic highway" for information exchange unlike anything seen to date.

A principal requirement for the creation of this brave new world of networked information was the creation of a standard set of protocols and communication mechanisms to allow users on disparate networks to share information. Such mechanisms have allowed the creation of the Internet, a global network of networks that now span the globe, connecting millions of users on hundreds of thousands of computers.

The Internet now connects universities, colleges and other centres of learning with commercial research and development groups throughout the world. It serves as both a live testbed for on-going networking research and a daily communications tool for thousands of users in fields far removed from networking and computer science. One recent survey estimates that the Internet currently has over 535,000 attached hosts in over 30 countries, with a user community estimated at over three million people.

The existence of this global information service has in turn spurred the development of mechanisms for locating and exchanging information. Distributed file systems, on-line file archiving mechanisms, electronic mail and bulletin boards and expert systems for locating and accessing technical expertise are all services that exist now on the Internet.

The huge size (and continued rapid growth) of the Internet offer a particular challenge to systems designers and service providers in this new environment. Before a user can effectively exploit any of the services offered by the Internet community the user must be aware of both the existence of the service and the host or hosts on which it is available. Adequately addressing this "resource discovery problem" is a central challenge for both service providers and users wishing to capitalize on the possibilities of the Internet.

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What is the archie service?

The archie service is a collection of resource discovery tools that together provide an electronic directory service for locating information in an Internet environment. Originally created to track the contents of anonymous ftp archive sites, the archie service is now being expanded to include a variety of other on-line directories and resource listings.

Users can access an archie server either through interactive sessions (provided they have a direct Internet connection) or through queries sent via electronic mail messages (provided they can at least gateway electronic mail messages onto the Internet).

Interactive access to archie may be through a conventional telnet session to a machine running an archie server or through a program that has been integrated into a larger system, such as the Prospero network distributed file system. Additional stand-alone clients are now being tested and are available over the network.

Why use archie?

The existence of the archie service allow those seeking information maintained by an archie server to limit their network search to a set of questions to a known server. The responses in turn offer pointers to specific Internet service providers. Once the existence and location of specific information or services has been determined using archie, traditional networking tools can be used for final access.

Programs have already been created that integrate an archie client with the ftp file transfer program or into larger information access services. This allows a user to first locate and then access information from archie sites using a single program.

The archie Service Today

Currently, archie tracks the contents of over 800 anonymous ftp archive sites containing some 1,000,000 files throughout the Internet. Collectively, these files represent well over 100 Gigabytes (100,000,000,000 bytes) of information, with additional information being added daily. Anonymous ftp archive sites offer software, data and other information that can be copied and used without charge by anyone with connection to the Internet.

The archie server automatically updates the listing information from each site about once a month, ensuring users that the information they receive is reasonably timely, without imposing an undue load on the archive sites or network bandwidth.

The "whatis" database

In addition to offering access to anonymous ftp listings, archie also permits access to the "whatis" description database. This database is a collection of descriptions that includes the name and a brief synopsis for over 3,500 public domain software packages, datasets and informational documents located on the Internet.

Additional "whatis" databases are scheduled to be added in the coming months. Planned offerings include listings for the names and locations of on-line library catalogue programs, the names of publicly accessible electronic mailing lists and compilations of Frequently Asked Questions lists and archive sites for the most popular Usenet "newsgroups" or bulletin boards. Suggestions for additional descriptions or locations databases are welcomed and should be sent to the archie developers at "archie-l@archie.mcgill.ca".

Service providers are also encouraged to send in details of their offerings to the archie maintainers so that the server tracking software can be configured to automatically perform updates when site information changes. An automatic registration mechanism has also been proposed that would allow service providers to make their service available without human intervention. This feature is expected to be integrated into an upcoming release.

Using archie

Users with direct Internet connectivity can try out an interactive archie server using the basic "telnet" command (available at most sites). To use, telnet to the host "archie.mcgill.ca" [132.206.2.3] and login as user "archie" (there is no password needed). A banner message giving latest developments and information on the archie project will be displayed and then the command prompt will appear. First-time users should try the "help" command to get started.

Users with only email connectivity to the Internet should send a message to "archie@archie.mcgill.ca", with the single word "help" in either the subject line or body of the message. You should receive back an email message explaining how to use the email archie server, along with details of an email-based ftp server operated by Digital Equipment Corporation that will perform ftp transfers through email requests.

Demo archie clients are stored on archie.mcgill.ca in the subdirectory "archie/clients" and may be obtained using anonymous ftp. There are several such clients and others are currently being tested. Additional work is planned in this area in the coming months and details will be announced in the archie banner message displayed on login.

Documentation for the archie system is still limited, but what there is is also available for anonymous ftp from the same host under the directory "archie/doc".

Miscellaneous Information

The archie service began as a project for students and volunteer staff at the McGill University School of Computer Science. It is now offered as a network resource by a number of sites. At the time this article was prepared, archie servers are being operated as "archie.mcgill.ca" (by McGill University in Montreal, Canada), "archie.sura.net" (by SURAnet in Maryland, USA), "archie.funet.fi" (by FUnet in Finland) and "archie.au" (by AARnet in Australia), archie.doc.ic.ac.uk, (Imperial College, London, UK) as well as others in New Zealand, Israel and Japan.

The archie project continues to grow in part because of the feedback and response from users. Suggestions for improvements and additional features are especially welcome. Please let us know what you think...

Contacting the archie people

Email addresses:

Please send comments, suggestions and bug reports to "archie-group@archie.mcgill.ca". This address reaches the implementors of archie.

There is also the "archie-people@archie.mcgill.ca" mailing list. This list is for people interested in developments and progress of the archie project and is open to all who wish to subscribe.

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Computing Centre,
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SPSS for OS/2 and SPSS/PC+: A Performance Comparison

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Introduction

UTCS recently received a review copy of SPSS for OS/2. Since UTCS currently supports SPSS/PC+, we wanted to compare the performance of the PC/DOS-based product with SPSS for OS/2. This article will illustrate how different hardware configurations and the different software versions perform the same statistical analyses. Performance is measured by time required to complete a group of tasks.

Please note that this article is not intended to be a comprehensive review of SPSS for OS/2. At the time of writing, UTCS has not made any decisions about obtaining site licences for SPSS for OS/2 or SPSS for Windows. Please watch for new site licence announcements in subsequent issues of *ComputerNews*. You may still obtain a site licence for SPSS/PC+ through the Information Office. Please call Evelyn Ward at 978-4990 for details.

Test Programs

We chose three test programs for this exercise. Two of the test programs (basetest.inc and stattest.inc) are the Base and Statistics module tests that come with SPSS/PC+ software. *Tables 1* and *2* list the SPSS commands that were compared for the purposes of this article. We omitted from the tables the SPSS commands that we did not compare and all the data lines. (In order for these programs to run in the OS/2 environment, lines one and

```
SET DISK=ON EJECT=ON SEED=2000000 LOG OFF VIEW 24.
set more=off listing='basepc.lis'.
TITLE 'Basetest.inc'.
* Test job for SPSS/PC+ base system.
...
FREQUENCIES  VARIABLES=AGE GRPAGE /FORMAT=LIMIT(10)/HBAR NORMAL
             INCREMENT(4).
DES SALARY79 TO SALARY82.
CROSSTABS DEPT82 BY GRPAGE BY SEX/ CELLS = COLUMN NONE
  / STATISTICS = CHISQ GAMMA.
SORT CASES and PLOT require the L module to be installed.
SORT CASES BY EMPNAME.
PLOT HORIZONTAL='Raise in 1982' MIN(0)/VERTICAL=MIN(0)
             /SYMBOLS='∞±≤¤'/PLOT RAISE81 WITH RAISE82.
PROCESS IF (GRPAGE = 5)
TITLE 'List of Employees over 50'.
LIST VARIABLES = EMPNAME SALARY80 RAISE80.
TITLE 'Motorcycle statistics - Street models'.
DATA LIST /make 1-10 (A) model 11-20 (A) numcyl 21
           engcc 24-29 (2) etime 33-37 (2) etmph 40-45 (2)
           topspd 48-50 wt 53-55 mileage 59-63 (A)
           brak60 67-69.
VARIABLE LABELS NUMCYL 'Number of cylinders'
                ENGCC 'Engine size in C.C.'
                ETIME 'Elapsed time in quarter mile'
                ETMPH 'Top speed in quarter mile'
                TOPSPD 'Maximum speed'
                MILEAGE 'Minimum and maximum miles per gallon'
                BRAK60 'Stopping distance from 60 to 0 MPH'.
FORMAT engcc (comma7.1) .
BEGIN DATA
...
END DATA
TRANSLATE to LOTUS3.WK3/ fieldnames/map /REPLACE.
TRANSLATE to LOTUS2.WK1/ fieldnames/map /REPLACE.
TRANSLATE to SYMPHONY.WRK/ fieldnames/map /REPLACE.
TRANSLATE to DBASE4.DBF/ type=DB4/map /REPLACE.
TRANSLATE to DBASE3.DBF/ type=DB3/map /REPLACE.
TRANSLATE to EXCEL.SLK/ fieldnames/map /REPLACE.
FINISH
```

Table 1

two of each program were commented out.)

We nicknamed the third test program “crash test” since this was a real factor analysis problem that would not run under SPSS/PC+ (see *Table 3*). This factor analysis was designed to derive the first 11 factors from 156 items. There was not enough memory to complete the analysis under SPSS/PC+. We decided, however, to run this problem under SPSS for OS/2 and SPSS for CMS to see if other versions of the software could complete the analysis.

SPSS for OS/2 and SPSS/PC+ both provide time of execution information in the program listing files. Since the OS/2 version of SPSS provides the number of seconds that the procedure takes to run, we converted the time stamps in the SPSS/PC+ listing to elapsed seconds for comparison, and also calculated total elapsed time. (We eliminated the first data manipulation section from the total time for the basetest and stattest programs since we could not calculate elapsed time from the SPSS/PC+ listings.)

```
SET DISK=ON EJECT=ON SEED=2000000 LOG OFF VIEW 24.
set more=off listing='statpc.lis'.
TITLE 'Stattest.inc'.
Test job for SPSS/PC+ statistics option.
...
REGRESSION and ANOVA require the A module to be installed.
TITLE ' '.
REGRESSION VARIABLES=AGE RAISE80 RAISE82 RAISE81/DEPENDENT=RAISE
           /ENTER/RESIDUALS ID(EMPNAME)/CASEWISE OUTLIERS(2).
ANOVA RAISE82 BY SEX(1,2) WITH AGE/STATISTICS 1.
DATA LIST  /CASEID 1-2 SURVIVAL 4 TREATMNT 6 TIME 8-10(1)
  WEIGHT 12-15(3) APGAR 17-18 SEX 20 AGE 22-23
  PO2 25-27 PCO2 29-31 PH 33-35(2) RESP 37.
VAR LABELS  SURVIVAL 'Infant survival'
  TREATMNT 'Treatment administered'
  TIME 'Time to spontaneous respiration'
  WEIGHT 'Birthweight in kilograms'
  APGAR 'APGAR score'
  SEX 'Sex of respondent'
  AGE 'Gestation age'
  PO2 'O2 level'
  PCO2 'CO2 level'
  PH 'PH level'
  RESP 'Respiratory level'.
RECODE SURVIVAL (0=1)(1=2).
VALUE LABELS SURVIVAL 1 'Die' 2 'Survive'/
  TREATMNT 1 'THAM' 0 'Sodium bicarbonate'/
  SEX 1 'Male' 0 'Female'/
  RESP 1 'Yes' 0 'No' 9 'No answer'/.
MISSING VALUES  PCO2(-1)/RESP(9).
BEGIN DATA
...
END DATA.
FACTOR VARIABLES=TIME WEIGHT APGAR AGE PO2 PCO2 PH RESP.
FINISH
```

Table 2

```
IMPORT FILE='c:\stattest\diane.xpt'.
FACTOR VARIABLES=uf1 to uf156
  /PRINT = EXTRACTION ROTATION KMO
  /FORMAT=SORT
  /CRITERIA=FACTORS(11).
```

Table 3

Equipment Configuration

Hardware

Our goal in testing was to create as level a playing field as possible. We wanted to observe the effects that different central processing units (CPUs), coprocessors, and operating systems might have on the performance of SPSS. We were able to achieve an environment with equal CPU speed (all processors were running at 25 megahertz (MHz)), and equal disk speed (we used the same model disk for all testing).

We chose a Commodore DT 386/486 computer for testing because both the 80486 and 80386 models use the same motherboard. This allowed us to eliminate the effects of motherboard design while testing the performance differences between the 80486 CPU and 80386/80387 CPU combinations. We had three such units, one with an 80486 CPU, one with an 80386 CPU plus an 80387 coprocessor, and another with only the 80386 CPU. All CPUs had a 25MHz clock speed and all computers had eight megabytes (MB) of RAM. The 80386 computers were equipped with a 64 kilobyte (KB) memory cache.

To run the tests, we installed DOS 5.0 and OS/2 2.0 on identical 100MB Quantum IDE type drives. Each drive had the appropriate copies of SPSS installed, as well as the relevant data files and test programs. We exchanged these drives among the three computers in order to run the programs using the different CPUs.

Basetest

	80486	80386 with 80387 coprocessor	80386
DOS	36	41	43
OS/2	10	20	27

Table 4

Stattest

	80486	80386 with 80387 coprocessor	80386
DOS	26	25	32
OS/2	5	13	20

Table 5

Crash Test

	80486	80386 with 80387 coprocessor	80386	CMS
OS/2	256	713	10061	
CMS				275

Table 6

Software

Configuring a comparable software environment was more difficult than equalizing the hardware. The DOS version of SPSS has a very limited ability to take advantage of additional memory. The two operating systems, DOS 5.0 and OS/2, also make different use of memory. This affects both the performance and the size of problems that can be analyzed. As a result, we tried to configure the software to obtain maximum benefit of the available resources for the specific situation. In other words, SPSS for OS/2 could use 8MB of memory, and SPSS/PC+ could use 64KB of expanded memory.

We used DOS 5.0 configured with the HIMEM.SYS command and the EMM368.EXE command to load the operating system into high memory. This made 612KB of conventional memory available to SPSS.

From the perspective of SPSS, configuring the OS/2 2.0 environment is very simple. The virtual memory capability of OS/2 automatically allocates memory such that both large problems and small problems make good use of the available resources. OS/2 was configured with a single high-performance-file-system (HPFS) partition on the hard disk, which provides faster access to information and programs than DOS 5.0. While OS/2 has multitasking capabilities (the ability to run several programs at the same time) we conducted all tests with only one program running at a time.

Results

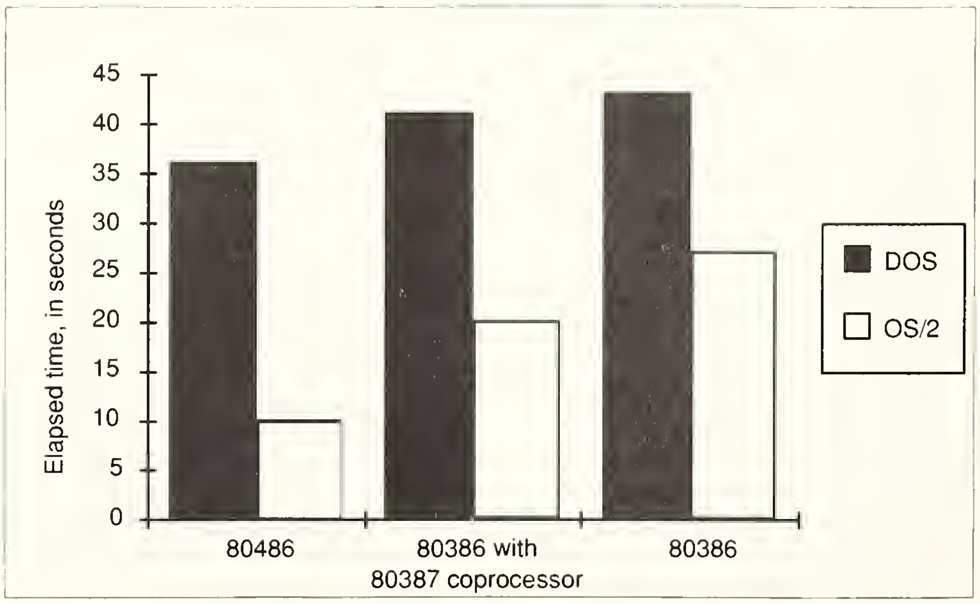
We ran the three test programs under the three hardware configurations as described above. We ran them only once, and the results illustrate expected performance under similar conditions. The results were not rigorously reproduced by replication of the test runs. *Tables 4, 5,* and *6* display our test program results for the basetest, stattest, and crash test, respectively (in seconds). *Charts 1, 2,* and *3* help to illustrate the performance differences.

For more details about the test run results, please contact the authors.

Conclusions

Statistical analyses involve many numerical calculations, so it is not surprising that the most obvious factor affecting the speed of the benchmarks was the CPU. Here the key factor is the presence of a coprocessor. The crash test best

Chart 1



illustrates this; the 25MHz 80486 machine (which has a floating-point coprocessor built in) was almost 40 times faster than the 25MHz 80386 machine without a coprocessor. The 80386 machine that was equipped with the 80387 coprocessor was 14 times faster than the 80386 alone. The 80486 was about three times faster than the 80386/80387 combination.

This is good news for owners of 80386 systems, since most computers provide a socket that accesses the 80387 chip. The cost of these chips is currently in the CDN$250 - CDN$300 range, which is considerably less expensive than buying a new computer.

The effect of DOS and OS/2 on performance was a pleasant surprise. The OS/2 version performed faster and could handle more complex problems. In the results for the basetest and stattest, we see the OS/2 version posting times between two and five times faster than DOS. Another advantage of SPSS for OS/2 is demonstrated in the crash test. The DOS version of SPSS could not handle the problem. The OS/2 version running on the same hardware worked.

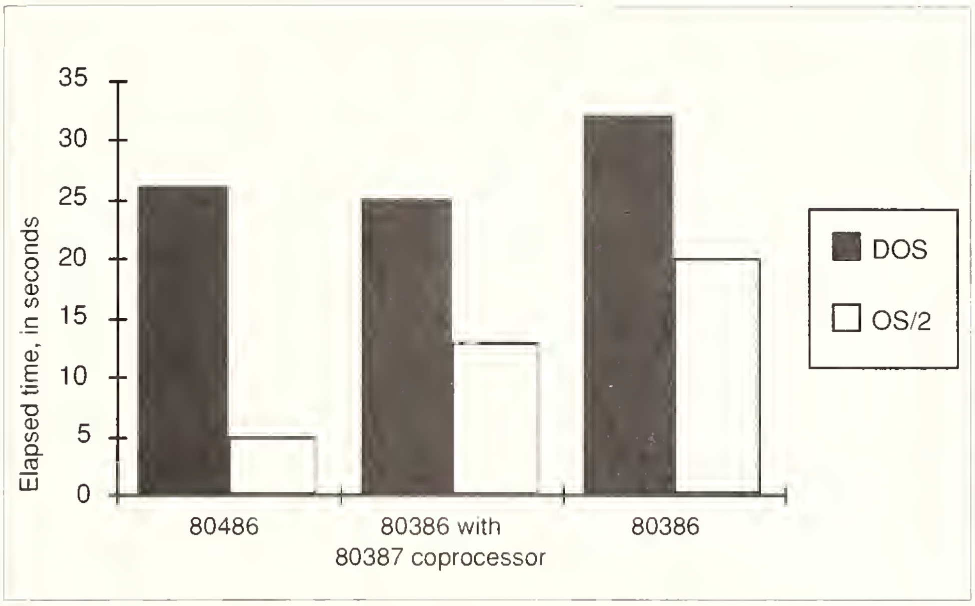


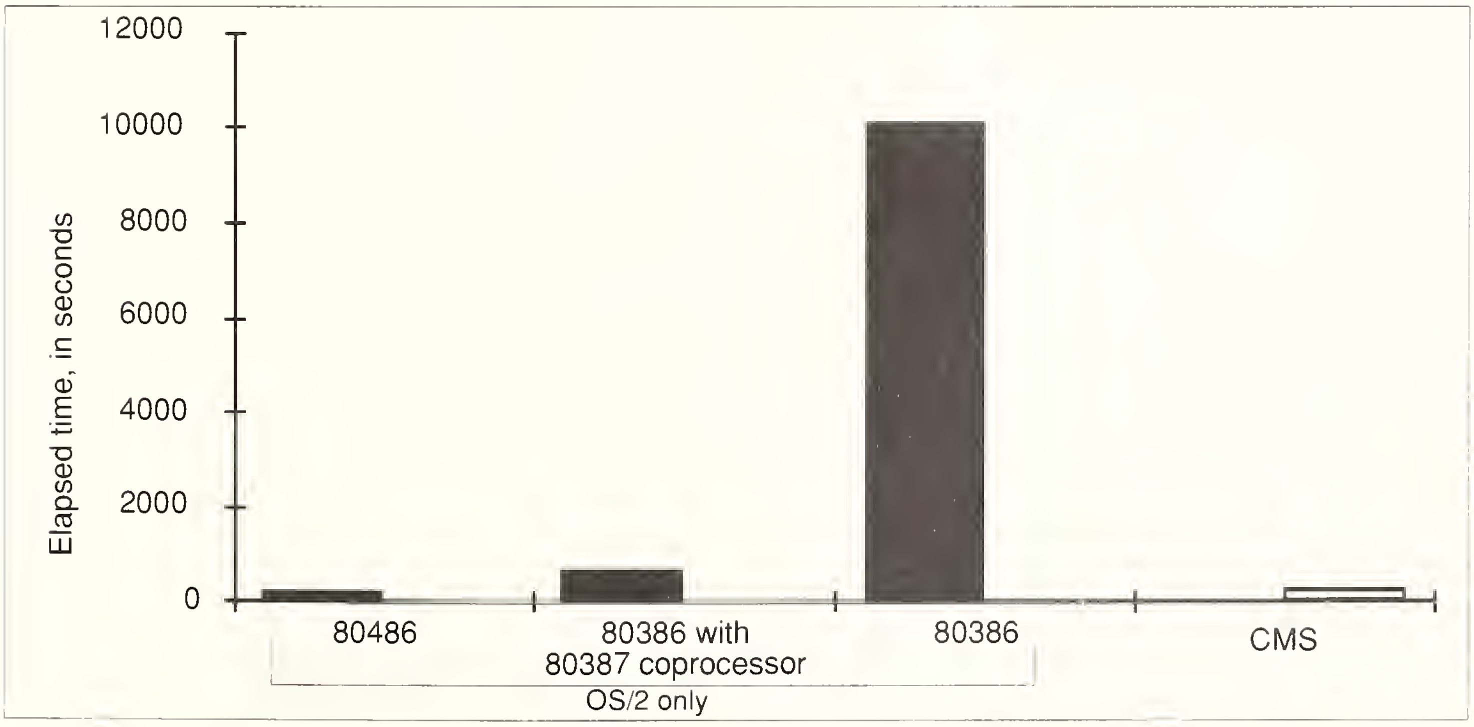
Chart 2

Under SPSS for CMS, the performance of the crash test was comparable to the 80486 system. CMS results, however, depend on the CMS system demands at the time of running. The advantage to SPSS users is that SPSS for OS/2 will permit them to do all their analytical work on a personal computer, thus avoiding having to learn how to operate in a mainframe environment such as CMS.

By changing from the DOS to the OS/2 operating system, and obtaining SPSS for OS/2 while maintaining the same hardware configuration, SPSS users can work faster and handle more difficult problems.

If you have any questions or comments about this article, please contact Sandra Gardner at 978-5128 or David Sutherland at 978-5426.

Chart 3



Graphics Programs for UNIX Systems Running X-windows

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In the past I have reviewed in *ComputerNews* a number of graphics programs for DOS machines, both commercial and public domain or shareware. With more and more people acquiring UNIX workstations, there seems to be a growing need for easy-to-use and inexpensive graphics programs for UNIX machines. Several such programs are available from various anonymous ftp sites. Below are descriptions of three public-domain programs written by Kenny K.H. Toh (*ktoh@td2cad.intel.com*).

Originally I obtained the programs from an anonymous ftp site, but I had trouble getting them to work under SunOS 4.1.3. When I contacted the author he kindly sent me the newest versions, which work very nicely. Anyone who would like to obtain the programs should contact Andrzej Pindor at 978-5045 or by electronic mail at *pindor@breeze.utcs.utoronto.ca*.

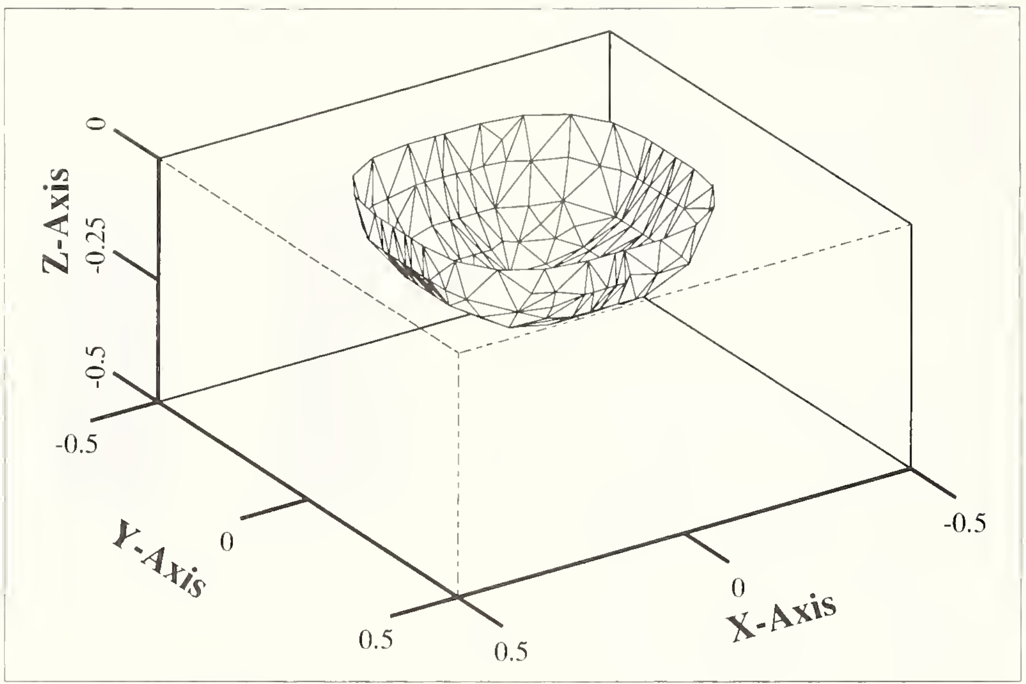


Figure 1: surface plot

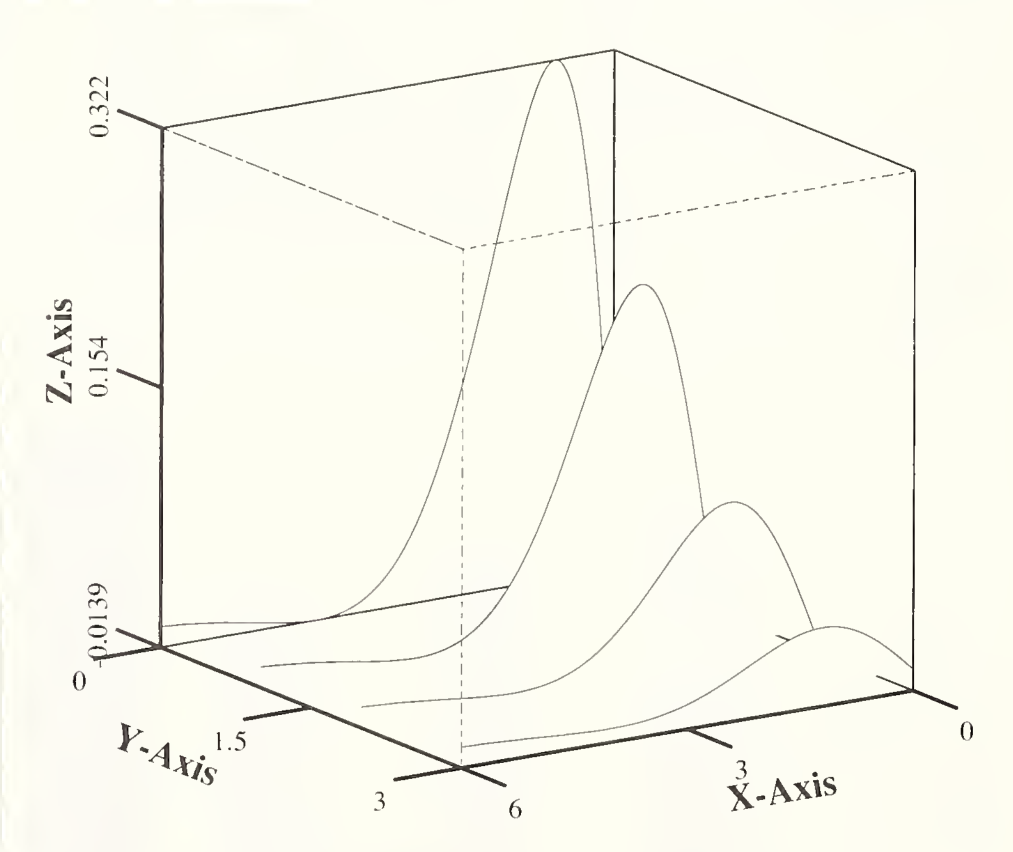


Figure 2: 3D line plot

drawplot

drawplot is a program for drawing 2D plots on X11 windows. The program will also produce a PostScript plot which can be sent to any compatible printer. You can use **drawplot** to read x-y data from a plot-file and manipulate that data according to options specified either in the command line or in an options file. The plot-file can be compressed; the program will uncompress it automatically.

The plot can be drawn in a normal or landscape mode, both axes can be scaled logarithmically, and axes and lines can be labelled by the user. There are 10 different line types available and 16 different marker types.

pdraw

pdraw creates 3D plots for X-windows and PostScript printers. It is designed specifically to draw lines in 3D space. Surfaces can be drawn by covering them with a mesh of lines, as shown in *Figure 1* (previous page), where a surface is formed by a mesh of triangles. You can rotate a graph interactively in a plot window and also plot the image projected on the x-y, x-z, or y-z plane. The final view angle will be saved and used for a PostScript plot. You then receive a prompt asking whether you want to send the plot to a printer. Many of the options are similar to the ones for **drawplot.** *Figures 1* and *2* (previous page) show examples of the plots created by **pdraw.** The figures also demonstrate the programs' hidden-line removal capability, although you should be aware that the hidden lines removal algorithm used sometimes gives unexpected (and undesirable) results.

contour

contour is a program for creating contour plots for X-windows and PostScript. It works in a manner very similar to **drawplot** and **pdraw.** It expects the data on a rectangular grid, which it then subdivides into smaller triangles for the contour calculation. These triangles can be output in a form suitable for input to **pdraw,** which can then create a nicely interpolated surface. *Figure 3* shows an example of a contour plot, and *Figure 4* a surface drawn by **pdraw** using interpolating triangles from **contour.**

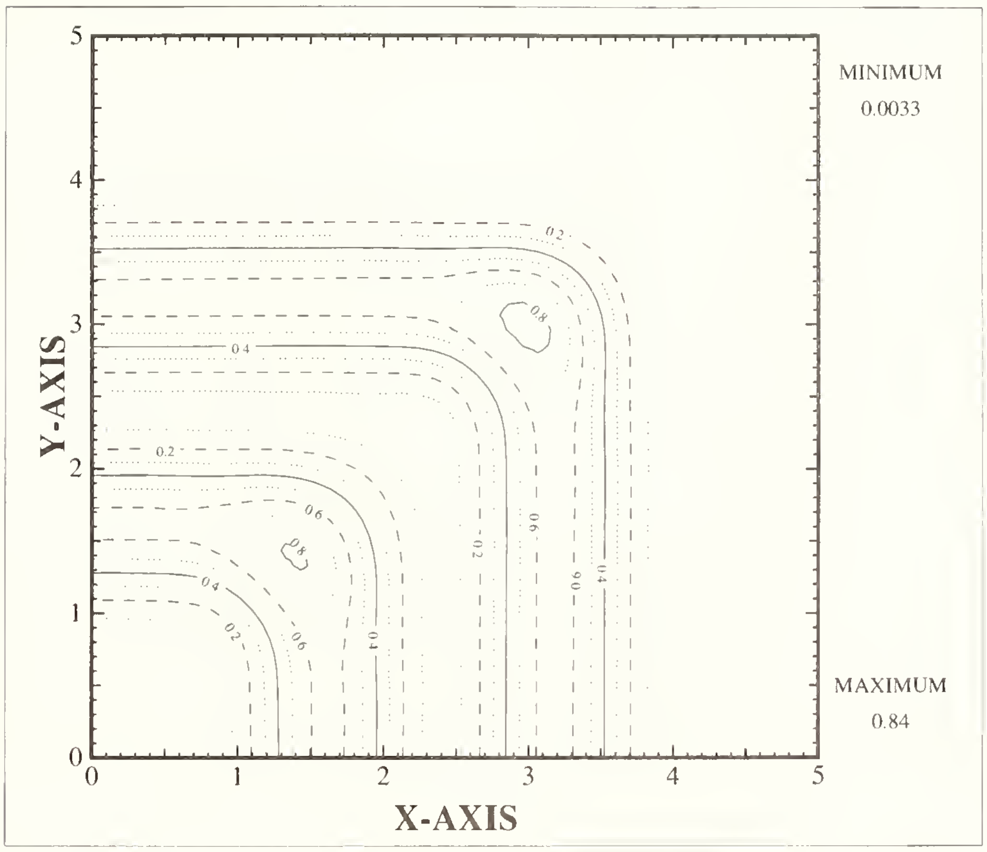
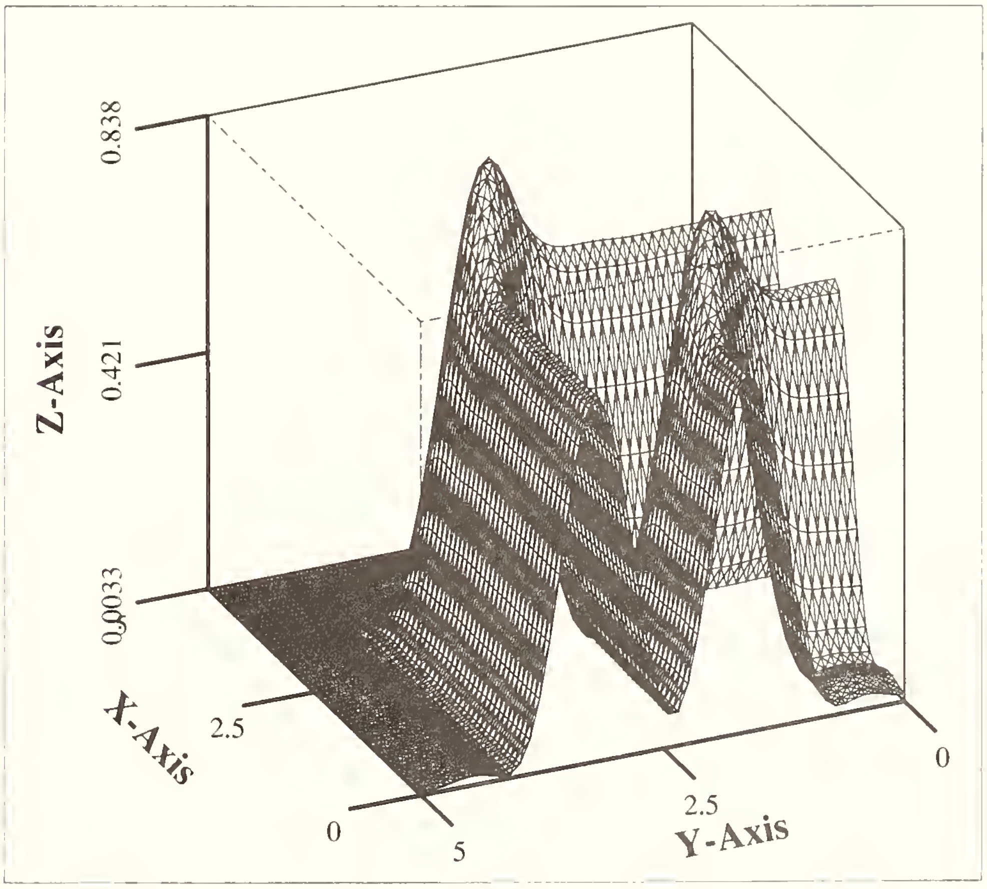


Figure 3: contour plot

Figure 4: surface from contour data



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- CMS timesharing system, VM/SP Release 6
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- RSCS spooling system, Release 2.3

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  - file transfer: ProComm, MacKermit
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- produces *ComputerNews*, the *Computing & Communications Newsletter*, and assists in the production of the UTCC Annual Report

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Managers:				
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Administration & Information Services	Ron Vander Kraats	BC121A	978-4428	rvk@vm.utcs.utoronto.ca

Legend:
BC = Bancroft Building
ER = Erindale
MP = McLennan Physical Labs

* NetNorth/BITNET/EARN

Names and Locations

Central Advising Office (CAO), 978-HELP
Engineering Annex (EA), 11 King's College Road, Room 107B
Erindale College (Erin), 828-5339, 3359 Mississauga Road North, Erindale Campus, Rooms 2037, 2045
Ramsay Wright, 25 Harbord St., Rooms 211, 213
Robarts, Robarts Library, 130 St. George St., Room 1061A
Sidney Smith (Sidney), 100 St. George St., Room 1071, 2105
St. Michael's College, 121 St. Joseph St., Room 107
Trinity College, 6 Hoskin Ave., Room 024
Victoria University, 73 Queen's Park Cres., 1st floor

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EA	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Erin (2045)	9:00-22:00	9:00-22:00	12:00-18:00	12:00-18:00	None	Rm 2005
Ramsay Wright	7:00-21:00	7:00-18:00	closed	closed	Undergrads	No
Robarts	8:30-24:00	8:30-24:00	9:00-22:00	13:00-22:00	None	978-HELP for Research
Sidney	7:00-24:00	7:00-24:00	7:00-24:00	7:00-24:00	None	978-HELP for Research
~~**St. Michael's**~~	~~24 hrs~~	~~24 hrs~~	~~24 hrs~~	~~24 hrs~~	~~None~~	~~978-HELP for Research~~
~~**Trinity**~~	~~8:00-22:00~~	~~8:00-22:00~~	~~8:00-22:00~~	~~8:00-22:00~~	~~None~~	~~978-HELP for Research~~
Victoria	8:30-21:00	8:30-21:00	8:00-13:00	8:00-13:00	None	978-HELP for Research

Sites	Advising Hours
CAO	Monday through Friday, 12:00 - 18:00
Erin	Monday through Friday, 09:00 - 22:00

Please note that the St. Michael's and Trinity College sites will be closed for the summer until after the Labour Day weekend.

* Research includes graduates, faculty, staff

Computer and Printer Access

Sites	PACX	CDF/PC	CQUEST	Printers
EA	Y			Y*
Erin	Y			Y*
Ramsay Wright			Y	Y**
Robarts	Y	Y		Y*
Sidney		Y	Y	Y**
St. Michael's	Y	Y		Y*
Trinity	Y	Y		
Victoria	Y			

(Y=yes, N=no)
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Each licence has a contract that you must complete. It outlines your responsibilities and any limitations in the use of the software. All contracts and software are available from the UTCS Information Office, 4 Bancroft Avenue, Room 201. To qualify as a member of the U of T community, you must provide a valid Employee number or Student number.

The table below describes the available site licences. The Restrictions column specifies who may purchase the licence. If the restriction is Research, the payment must come from research money. The Diskettes/Distribution column describes how you actually receive the software. Large packages, like SAS and SPSS, require that you borrow the diskettes, install the software, and return the diskettes. Smaller packages, consisting of up to five diskettes, require you to bring your own diskettes.

For more detailed information about these site licences, telephone the UTCS Information Office at 978-4990.

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Product/ Operating System	Cost	Restrictions	Licence Period	Diskettes/ Distribution	*
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CSLG					
There are over 250 individual software products included in this package.	$250.00	Departments with Digital hardware	One-time fee	Call 978-4595.	No
C++					
UNIX V, Release 2.1 Language System	$42.00	Faculty, Staff, Research	One-time fee	To purchase: call Evelyn Ward at 978-4990. Technical questions: Paul Kern at 978-4696.	No

*Documentation available at UTCS

Site Licences at UTCS *cont.*

Product/ Operating System	Cost	Restrictions	Licence Period	Diskettes/ Distribution	*
IMSL					
UNIX Class IVA machines; FORTRAN Subroutines		U of T-owned machines	One-time fee	Tape cartridge or network download	Yes
IMSL (MATH, STAT, SFUN):	$935.00				
Exponent Graphics:	$475.00				
C BASE Library:	$445.00				
Interactive Document Facility:	$140.00				
Environmental Install. & Assurance Tests:	$140.00				
Registration Fee:	$588.00				
IMSL					
UNIX Class IVB machines; FORTRAN Subroutines		U of T-owned machines	One-time fee	Tape cartridge or network download	Yes
IMSL (MATH, STAT, SFUN):	$565.00				
Exponent Graphics:	$285.00				
C BASE Library:	$265.00				
Interactive Document Facility:	$87.00				
Environmental Install. & Assurance Tests:	$87.00				
Registration Fee:	$588.00				
IMSL					
PC; FORTRAN Subroutines		U of T-owned machines	One-time fee	Deposit $100; borrow and return diskettes	Yes
IMSL (MATH, STAT, SFUN):	$195.00				
Maple (single machine or network server)					
DecStation 2100, 3100 (Ultrix)	$300.00	Staff	One-time fee	Borrow and return diskettes, tape cartridge; network download	Yes
DecStation 5000, 5100 (Ultrix)	$500.00				
DecStation 5400, 5800 (Ultrix)	$760.00				
HP 9000/300, HP 9000, 400 (HP-UX 7.0)	$300.00				
HP 9000/700, HP 9000, 800 (HP-UX 7.0)	$430.00				
Sun-3 (SUN OS 4.0)	$240.00				
Sun-4, SPARCstation (Sun OS 4.0)	$300.00				
SGI Personal IRIS (Irix)	$300.00				
SGI Professional IRIS 50-80GT (Irix)	$500.00				
SGI Professional IRIS 120-240GT (Irix)	$760.00				
PC-386 (DOS; UNIX)	$200.00				
MIPS, RC3230 (UNIX)	$300.00				
IBM RS6000 model 320 (AIX)	$300.00				
Macintosh (Finder)	$130.00				
Note: station cost is half the single machine price.					

Note: Only available until September 3, 1992.

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Site Licences at UTCS *cont.*

Product/ Operating System	Cost	Restrictions	Licence Period	Diskettes/ Distribution	*
Novell Netware 3.11 — 20-user Licence					
PC; LAN Server Licence: Upgrade Licence: Upgrade from Other Vendor's Software:	$2506.00 $1392.00 $2088.00	University Depart-ments	One-time fee	Deposit $50; borrow and return diskettes	Yes
Novell Netware 3.11 — 100-user Licence					
PC; LAN Server Licence: Upgrade Licence: Upgrade from Other Vendor's Software:	$4873.00 $2088.00 $3480.00	University Depart-ments	One-time fee	Deposit $50; borrow and return diskettes	Yes
Other Novell Products					
Mac Netware 3.0: Novell Netware NFS	$438.00 $1392.00	University Depart-ments	One-time fee	Deposit $50; borrow and return diskettes	Yes
ProComm					
PC; Communications Note: Documentation on disk; part of package	Free	Faculty, Staff, Graduate Students, Under-graduate	N/A	Two 5.25"; bring own	Yes
QuickMail					
Mac; Electronic mail Per user: Upgrades:	$35.00 $17.00	Faculty, Staff	One-time fee	One 3.5"; bring own	No

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Site Licences at UTCS *cont.*

Product/ Operating System	Cost	Restrictions	Licence Period	Diskettes/ Distribution	*
SAS/PC					
PC; Statistical analysis BASE/STAT/GRAPH/FSP: IML module: ETS module:	 $35.00 $31.00 $31.00	Faculty, Staff, Graduate Students, Undergraduate	July 1- June 30	Deposit per binder (Maximum $100); borrow and return diskettes	Yes
SAS/PC network					
PC; Statistical analysis Per station: IML, ETS modules each per station	 $17.00 $16.00	Faculty, Staff, Graduate Students	July 1- June 30	Deposit per binder (Maximum $100); borrow and return diskettes	Yes
SAS/UNIX (Sun-3 & Sun-4)					
UNIX; Statistical analysis Sun-3, Sun-4/1xxx and Sun-4/2xxx (all modules): Sun-4/330:	 $388.00 $776.00	Faculty, Staff, Graduate Students	July 1- June 30	Tape cartridge	Yes
SAS/UNIX (Sun-3 & Sun-4) Network					
UNIX; Statistical analysis Per server* (all modules): *Each server counts as 10 workunits regardless of the number of stations being served.	 $3880.00	Faculty, Staff, Graduate Students	July 1- June 30	Tape cartridge	Yes
SPSS/PC					
PC; Statistical analysis Full Package: Data Entry Module Only:	 $40.00 $20.00	Research	Nov 1- Oct 31	Deposit max. $50; borrow and return diskettes	No
SPSS/PC network					
PC; Statistical analysis Full Package: Data Entry Module Only:	 $20.00 per station, plus server $10.00 per station, plus server	Research	Nov 1- Oct 31	Deposit max. $50; borrow and return diskettes	No

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Site Licences at UTCS
cont.

Product/ Operating System	Cost	Restrictions	Licence Period	Diskettes/ Distribution	*
SYSTAT version 5.X					
Mac 5.2; DOS 5.0; Statistical analysis	$80.00	Faculty, Staff, Graduate Students	July 1-June 30	Six 800KB 3.5" diskettes; bring own	Yes
SYSTAT network version 5.1					
Mac; Statistical analysis Price per station, plus server:	$40.00	Faculty, Staff, Graduate Students	July 1-June 30	Six 800KB 3.5" diskettes; bring own	Yes
UNIX V, Release 4					
Operating System	$18.00	Faculty, Staff, Research	One-time fee	*Send electronic mail to molnar@gpu.utcs.utoronto.ca*	No
WATFOR-77					
PC; FORTRAN compiler [$35 WATFOR-87 (math co-processor)] GKS (Graphics Kernal System)	$35.00 Add $5.00	Research	July 1-June 30	Two-three 5.25" diskettes; bring own	Yes
WordPerfect (individual & networked machines)					
PC; WordProcessing New, per machine: Upgrade, per machine:	$42.00 $15.00	Faculty, Staff	One-time fee	Deposit $25; borrow and return diskettes	Yes

***Documentation available at UTCS**

PC Maintenance

Below is a listing of some microcomputer equipment which UTCS Micro Sales & Maintenance covers under yearly maintenance contracts. All contracts are based on a minimum 12 month period. Service calls are handled on a first-priority basis. Average response time is four hours. Equipment must be certified as operational prior to commencement of a maintenance contract. (There is no extra charge for this service.) Please contact UTCS Micro Sales & Maintenance at 978-5050 or 978-1299 to obtain service and pricing information.

IBM PC or Compatible Equipment

Systems
IBM PC PS/2 systems or compatibles
386, 486 systems
Notebooks
Laptops

Disk Drives
360KB & 1.2MB 5.25-inch Floppy
720KB & 1.4MB 3.5-inch Floppy

Hard Disk Drives
20 to 320 Megabyte

Displays
Monochrome
CGA / EGA / VGA Colour
PS/2 Monochrome/Colour
Most monitors

Modems
1200 & 2400 baud

Laser Printers
HP LaserJet
HP LaserJet II
PS Jet +
QMS PS 800
QMS PS 800+
QMS 810

Dot Matrix Printers
C-ITOH
Epson
IBM
NEC
Panasonic
Roland
Toshiba
Most makes

Apple Macintosh Equipment

Systems
Mac 128, 512, Plus
Mac Classic - All Models
Mac LC - All Models
Mac SE - All Models
Mac SE/30 - All Models
Mac II, IIx, IIcx, IIci, IIsi, IIfx
PowerBooks
Quadras

Disk Drives
400KB, 800KB 3.5-inch Floppy
1.4MB 3.5-inch Floppy

Hard Disk Drives
20 to 320 Megabyte

Displays
Apple Mac 12-inch Monochrome
Apple Mac 12-inch RGB
Apple High-Res 12-inch Monochrome
Apple High-Res 13-inch Colour

Modems
1200 & 2400 baud

Laser Printers
Personal LaserWriter LS
Personal LaserWriter NT
LaserWriter
LaserWriter Plus
LaserWriter IINT
LaserWriter IINTX

Dot Matrix Printers
ImageWriter I
ImageWriter II
ImageWriter II/L
Apple StyleWriter

UTCS also supplies and installs floppy disk drives, hard disk drives, video and other boards, math coprocessors, and memory upgrades.

Support for UNIX

We support timesharing on GP UNIX under Sun OS 4.1.1.

Support for VM/CMS

We support CMS release 6.0 under CP/HPO releave 6.0 For CMS support, call Supervisor Ted Sikorski at 978-6602.

Support by UTCS Advising

The following are microcomputer software packages supported by the UTCS Advising and Consulting Group. This service is available to University of Toronto faculty, staff, and graduate students. For assistance with the products listed below, call 978-HELP, Monday through Friday, between 12:00 noon and 6:00 p.m.

Package/Compiler	Version	Environment
Communications		
File Transfer & Terminal Emulators		
MacKermit	0.99(94)	Macintosh
ProComm	TU 2.4.2	MS-DOS
Database Managers		
dBASE IV	1.5	MS-DOS
FoxBASE Mac	2.01	Macintosh
Electronic Mail		
QuickMail	2.2.3	Macintosh
Operating Systems		
IBM PC & Compatibles		
Microsoft MS-DOS (incl. IBM PC-DOS)	5.0	n/a
Macintosh		
Finder	6.0.X	n/a
MultiFinder	6.0.X	n/a
System	6.0.X	n/a
Spreadsheet & Charting		
Lotus 1-2-3	2.02	MS-DOS
Microsoft Excel	2.2a, 3.0	Macintosh
Statistical		
SAS/PC	6.04	MS-DOS
SPSS/PC+	4.0	MS-DOS
SYSTAT	5.1	Macintosh
SYSTAT	5.03	MS-DOS
SAS	5.18, 6.07*	VM/CMS
SPSS	3.1, 4.1	VM/CMS
SAS	6.03, 6.07	UNIX, Sun-3, Sun-4
Word Processing		
Microsoft Word	4.0	Macintosh
WordPerfect	5.1	MS-DOS

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